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VOLUME XII SEPTEMBER 10, 1923 NUMBER 19

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VOLUME XII NEW YORK, SEPTEMBER 10, 1923 NUMBER 19

The Dyeing of Artificial Silk

Various Kinds of Artificial Silk—Cuprate and Viscose Silks—Cellulose Acetate Silk—Detection of the Various Silks—Bleaching Before Dyeing—General Details of Dyeing—Uniformity—Dyes Used—Dyeing at Higher Temperatures—Use of Basic Dyestuffs—Substantive Dyes—Sulphur, Acid and Vat Dyes

By ISMAR GINSBERG, B.Sc., Chem. Eng.

ARTIFICIAL silk is a fiber of vegetable origin. In this respect it is entirely different from natural silk, which is of animal origin. The artificial product is made from cellulose, particularly cotton cellulose, although wood cellulose is used in certain processes, and consequently it is to be expected that the dyeing of certain grades of artificial silk is similar in certain respects to the dyeing of cotton. The methods used in coloring other grades of artificial silk, moreover, are altogether different from those used in the dyeing of natural silk. In fact, aside from its name and its appearance, in which it bears a close resemblance to natural silk, artificial silk is an entirely different product which must generally be handled, finished, bleached and dyed by entirely different processes than those employed in the natural silk industry.

Various Kinds of Artificial Silk

While the dyeing of certain artificial silks is similar in many of its principles to the dyeing of cotton, there are various precautions that have to be taken in the former process due to the peculiar properties of the product. Furthermore, the different varieties of artificial silk behave differently in the dyeing process and, in fact, it is essential under many conditions to know exactly what kind of artificial silk is being handled before it can be dyed successfully. The inherent properties of the product, the different forms in which it comes upon the market, give rise to certain difficulties in the dyeing process which must be overcome or circumvented in some way.

Up to within recent years there were just three kinds of artificial silk on the market; to-day there are four, the recent addition being cellulose acetate silk. The first type of artificial silk, discovered in 1885, is named after the first discoverer and inaugurator of the artificial silk industry, Chardonnet. It is known as Chardonnet or collodion silk. It is made from a solution of nitrated cotton in a mixture of ether and alcohol. A fine thread or fiber of nitrated cotton is produced and then denitrated by being subjected to the action of a solution of ammonium sulphide or other suitable denitrating agent which leaves a pure cellulose fiber. To this class of artificial silks belong, besides the Chardonnet silk, Lehner, Besancon and Frankfort silk. All these are characterized by very high luster and great flexibility. These silks possess a very strong affinity for the basic dyestuffs, which can be used in dyeing them without the aid of mordants. Generally, all that is necessary is to wet down the silk and place it in a solution of dyestuff maintained at a temperature of 40 deg. Cent. The dyeing process lasts half an hour. Because of their affinity for the basic dyestuffs, nitrocellulose artificial silks may be considered as resembling closely the animal fibers, wool and natural silk, which, possessing acid reactions, are dyed directly with the aid of basic dyestuffs. It has been held that the content of hydrocellulose and oxycellulose in the nitrated cotton silk is the cause of its strong affinity for the basic dyestuffs. On the other hand, it possesses only a slight affinity for the substantive dyes.

Cuprate and Viscose Silks

The next kind of artificial silk in historical sequence is cuprate or copper-ammonium silk, which was discovered in 1890 by Despaisis. This silk, which is also known as Glanzstoff, Sirius or Julich silk, is made from a solution of cotton in ammoniacal copper oxide. Pure cellulose is obtained by treating the spun threads with

an acid solution. This grade of artificial silk also possesses a high luster. In the manufacture of cuprate silk the composition of the cotton fiber is not changed as much as it is in Chardonnet silk; that is, there is probably less hydrocellulose and oxycellulose produced. Hence it not altogether unexpected that cuprate silk should act very much like cotton, and particularly mercerized cotton, in its behavior toward dyestuffs. It can be readily dyed with the substantive dyestuffs that are commonly employed in dyeing cotton fabrics.

Viscose silk, which is manufactured on a large scale in this country and which is to-day one of the most important, if not the most important, artificial silks on the market, was first made by Stearn in 1898. The starting material in this manufacture is viscose, which is a solution of cotton obtained by treating cotton or purified wood pulp with strong caustic soda and carbon disulphide. A pure cellulose fiber is obtained by removing the sulphur compounds after the thread has been spun. Viscose silk is very much like Glanzstoff, and besides possessing a strong affinity for the cotton substantive dyestuffs it will also readily absorb the basic dyestuffs, just like Chardonnet silk.

Cellulose Acetate Silk

The newest form of artificial silk is cellulose acetate silk. This has recently assumed greater importance due to the various improvements that have been made in its manufacture and subsequent finishing, which have removed its former harsh touch and unattractive appearance. One of the greatest difficulties which have had to be overcome in developing a market for this artificial silk is the dyeing problem. Due to the decidedly ester-like character of the silk, which is made from cotton converted into an acetyl ester by the action of glacial acetic acid or acetic anhydride, neither the direct cotton dyes nor most of the acid dyestuffs are absorbed by the fiber. In fact, the absorption capacity of the fiber is so little that it took almost four months for the fiber to be completely dyed with methylene blue. Certain methods have, however, been developed which have rendered the dyeing of the fiber a much easier task. Moreover, a new class of dyestuffs, known as the ionamines, has been discovered which possess a particular affinity for the cellulose acetate silk fiber.

Detection of the Various Silks

It is evident that the first step in the process of dyeing artificial silk is to determine what silk is at hand. This may be done by a simple test. A sample of silk is placed in a solution of 3 per cent methylene blue mixed with 2 per cent acetic acid. Chardonnet silk absorbs the color readily and assumes a marine-blue color, and the bath is easily and quickly exhausted. Cuprate and viscose silks are dyed only slightly and a thick dye bath is left after the dyeing process. Acetate silk will not be colored at all, but after having been soaked for a time in alcohol or other solvents the dyestuff is quickly absorbed into the fiber.

Bleaching Before Dyeing

As a general rule, it is unnecessary to bleach the artificial silk fiber before it is dyed, for it usually comes to the dyer sufficiently white to require no preliminary treatment. However, when a high-quality fiber is desired it is necessary to bleach the fiber, and sometimes the color of the same is such that even for a poorer grade product it is necessary to destroy the brownish-yellow coloration in order to secure good results in dyeing.

In bleaching the fiber the same process used in bleaching cotton may be employed, but a great deal of care must be taken to avoid tearing or injuring the silk; for, when wet, artificial silk of all varieties loses the greater part of its strength. One essential condition of the bleaching process is that it be carried out as quickly as possible, so as to avoid the weakening of the fiber by the bleaching solutions.

The chlorine bleaching compounds can be used for this purpose, weak solutions being employed, but it is generally considered better practice to bleach the artificial silk fiber with the aid of peroxide of hydrogen or peroxide of sodium. The fiber must be acidified by immersion in a bath of weak acid, after having come in contact with the bleaching solution, and then it must be washed with a lukewarm soap solution. It is also well to give it an antichlor treatment. These details need not be followed out when bleaching with the peroxides.

General Details of Dyeing Artificial Silk

No matter what dyestuff is used, what the character of the silk is or what dyeing process is employed, certain fundamental principles must be followed out religiously if a well-dyed product, possessing all the necessary characteristics of a first-grade artificial silk, is to be obtained. In the first place, the artificial silk fiber, being necessarily a weakened cotton fiber, does not possess great strength, and, furthermore, it loses almost all its strength when it becomes wet. Therefore, it is essential that the fiber be handled as little as possible. Then, again, the dyeing process should be carried out at a low temperature; in fact, the dye baths should be as cold as possible. Furthermore, strong alkalies must be avoided wherever possible. The use of alkalies in warm solutions quickly destroys the strength and elasticity of the silk. It is good practice to use copper dye baths in the place of wooden ones, owing to the fact that the latter often develop rough places on which the artificial silk is apt to get caught

and torn. Indirect steam heat is, moreover, preferred to direct steam heating, as in the latter case the dye is apt to go on the silk in an irregular fashion, and then, again, the churning effect of the introduction of free steam into the dye vat is likely to tangle the silk.

Uniformity of the Dyeing

Irregularities in the color of dyed artificial silk frequently occur in practical work. Streaks of color, either lighter or darker than the regular shade, are often found in the dyed silk. These irregularities in the color are not, for the most part, due to the dyeing process, the dye used or to the lack of skill on the part of the dyer himself. They have often been found to be due to the fact that the silken fabric or yarn contains artificial silk of different makes. In such cases it is almost impossible to obtain even dyeing.

In the case of Chardonnet silk, it sometimes happens that the denitration of the silk is not complete, with the result that one part of the fabric may be dyed a deeper shade than the rest. It is usually possible to overcome this particular difficulty in the dyeing of artificial silk by immersing the same in a bath of magnesium sulphydrate, washing, acidifying and thoroughly washing a second time.

In the case of cuprate silks, Glanzstoff, the irregularity in the dyeing of the fabric has been found to be due under certain conditions to the presence of copper in the artificial silk. This acts as a mordant and produces deeply colored streaks in the fabric. It is always good practice to acidify the cupra silk before dyeing. This removes any copper present in it.

Another condition that influences the uniformity of the dyeing in all kinds of artificial silks is the length of the dye vat. This should be greater than the length of the cotton dye bath, for it has been found that more uniform results are obtained when the dye bath is comparatively long. Furthermore, it is also essential to pass the solution of dyestuff, after it has been made, through a fine-meshed screen so as to remove all undissolved particles of dyestuff. When dyeing the brighter shades it is advisable to add the dye liquor in several portions to the dye bath. The goods should be lifted after every addition of dyestuff. It is also recommended that the silken goods be wetted down before being added to the dye bath.

Dyestuffs Used in Dyeing Process

The basic, acid, substantive, sulphur and vat dyestuffs are used in dyeing artificial silks, but, as has been mentioned above, certain of these classes of dyestuffs are more suitable for coloring one kind of artificial silk than another. However, it cannot be held any longer, as it has been considered up to within recent years that any dyestuff belonging to any of the above classes can be utilized with invariably good results in the dyeing process. Some of the dyes, particularly among the direct cotton colors and the sulphur colors, are so sensitive to variable affinity of the fiber for coloring matter that they will produce uneven shades on the silk fiber. It is well known that the individual fibers of any textile possess variable affinity for certain dyestuffs, but in the case of short fibers, such as cotton and wool, the variations are concealed by the mixing of a large number of fibers to form a thread, while in the case of artificial silk this hiding of the irregularity is not possible. Similarly with the basic colors, mordanted with the aid of tannic acid, the same unevenness of dye is found, for the tannic acid is taken up by the artificial silk fiber just like a dyestuff and an irregular mordanted fiber will be irregularly dyed by the basic color.

Hence great care must be taken in the selection of the dyestuff if even dyeing is to be secured. A great many dyestuffs have been tested and classified, a partial list being given in the Journal of Society of Chemical Industry, December 15, 1920, pages 322T to 324T. There are, of course, many direct cotton dyes which will give good even shades, while there are just as many that will give poor results in the dyeing.

Dyeing at Higher Temperatures

While it is almost a fundamental rule that the dyeing of artificial silk should be carried out at as low a temperature as possible, in order to avoid injuring the fiber, nevertheless the use of a higher temperature than ordinarily employed possesses certain advantages from the standpoint of the uniformity of the color produced on the artificial silk fabric. It appears that certain of the dyestuffs which give uneven shades on the silken fabric when the dyeing is conducted at the regular temperature will give uniform colors when the temperature is raised. In this process it is essential that the temperature of the bath be first brought to the proper point before the silk is introduced into it. The silk should not be heated up with the cold bath. In an experiment made to determine the relative affinities of the artificial silk fiber for a certain dyestuff at different temperatures it was found that while two different makes of artificial silk may be dyed at a temperature of 35 deg. Cent. and give shades which are six times as dark on one as on the other, nevertheless when the temperature of the dye bath was raised to 75 deg. Cent. the shades on the two varieties of silk approach each other until there is scarcely any difference between them; this in spite of the fact that the affinity of one type of artificial silk for the dye is much greater than the other.

When dyeing with a mixture of dyestuffs it is always necessary to see that all the colors in the mixture are capable of giving an even shade on the silk, otherwise the color will be uneven. Furthermore, it has been found a difficult matter to correct the unevenness of

the color on the silk after the latter is once dyed. For even after the silk is bleached and then dyed again with an even dyestuff, the final result will often be uneven as well. Certain of the sulphur dyestuffs fill in gaps in the ranks of the direct cotton dyestuffs which are able to give uniform colors on artificial silks.

Use of Basic Dyestuffs

Basic dyestuffs are particularly adapted to the dyeing of Chardonnet silks. They go on the silk without the use of a mordant at temperatures varying from 100 to 120 deg. Fahr. It is generally customary to acidify the dye bath with a little acetic acid. The duration of the dyeing is from half an hour to one hour. If dyed silks fast to washing are desired, it is expedient to mordant the fabrics before dyeing, particularly in the case of dark colors. When using basic dyestuffs on cuprate silks, mordanting is always advisable even for medium shades.

The mordanting is effected with the aid of tannin and tartar emetic. The first step in the process is to immerse the fabric for one or two hours in a bath containing from 2 to 5 per cent of tannin and 1 per cent hydrochloric acid. The mordant bath is maintained at a temperature of 50 deg. Cent. Too long or too strong mordanting is to be avoided, for the feel of the goods is impaired thereby. After the goods have been removed from the mordanting bath and wound up loosely or hydro-extracted, they are placed in a fresh cold bath containing from 1 to 2.5 per cent of tartar emetic. They are allowed to remain in this bath for twenty to thirty minutes. Then they are hydro-extracted again and thoroughly washed. It is better practice not to dry the goods after mordanting, but to dye them in the wet condition. In making up the dye bath it is necessary to avoid any contamination with soapy or oily materials, for these are apt to cause precipitation of the dyestuff on the artificial silk fiber and spotty dyeing.

Basic dyestuffs are very popular for artificial silk dyeing, due to the fact that they as a class possess the great advantage of giving the most even dyeing results. On the other hand, they are not very fast. It is to be noted that these dyestuffs all possess relatively low molecular weight. Certain investigations have shown that there seems to be some sort of a relation between the molecular weight of the dyestuff and the evenness of the shade produced on artificial silk fabrics; that is, the lower the molecular weight of the dyestuff the more uniform the shade.

Use of Substantive Dyes

These dyes are used more widely than any of the others in the dyeing of artificial silks. They are indicated particularly for coloring cuprate and viscose silks. In dyeing all shades the dye bath contains 1 to 2 per cent of soda, 2 to 4 per cent of Monopol soap, besides the dyestuff. The dyeing is accomplished at a temperature of 30 deg. Cent. and lasts half an hour. At the end of this time an addition of 5 to 10 per cent of Glauber salt is made. The soap and soda aid in producing goods with a good "handle." When dyeing medium shades, the proportion of Glauber salt is raised to 15 per cent; and while the temperature of the bath is 30 deg. Cent. at the start, it is gradually raised to 50 deg. Cent. and the dyeing is continued at that temperature for about half an hour. When dyeing dark shades, the percentage of Glauber salt is increased to 20 and the temperature gradually raised from 20 deg. Cent. at the start to 60 deg. Cent. at a maximum. The duration of the dyeing is forty-five minutes in this case. The addition of Glauber salt to the dye bath aids in the exhaustion of the bath, and hence there is more of this salt used with the dark shades than with the light, for the reason that the dark dye baths do not exhaust as readily as in the case of the light shades. The goods are washed after dyeing and the silk is given a scroop by being treated in an oil or oil emulsion bath. Olive oil or rapeseed oil is generally used for this purpose. By the addition of a little diastofor, a silk is obtained with an especially fine "handle."

Sulphur, Acid and Vat Dyes

These dyestuffs are also used to dye artificial silk. The sulphur dyes give particularly fast shades. The silks are dyed in a cold bath to which sodium sulphide, soda and Glauber salt are added. It is not good practice to use sulphur dyestuffs for producing blacks and dark blues on artificial silks, as the large proportion of alkali that must be added to the dye bath affects the luster and the "handle" of the silk too much. In dyeing cuprate and viscose silk with sulphur dyes, it is advisable to soap the goods after dyeing, then to wash them thoroughly and finally give them a treatment in a bath of weak acetic acid. In the case of Chardonnet silk, the same treatment is followed except that the soaping is omitted. It should be remembered that not every sulphur color will give uniform dyeing results.

The acid colors are used only where light shades are desired, as they possess only a slight affinity for the artificial silk fiber. Both Chardonnet and cuprate silks can be dyed with the acid colors for production of light shades.

The vat dyes are better suited for dyeing viscose and cuprate silks than for coloring Chardonnet or collodion silk. The dye bath must be freed from dissolved air before being added to the stock vat by means of caustic soda and hydrosulphite. It is absolutely necessary that the proportions of the two chemicals be fixed so that exactly the correct amounts are present in the bath so as to effect complete reduction of the coloring matter. Furthermore, the temperature of the dye bath must be exactly that which is indicated by the dye

manufacturer as being the proper one at which to conduct the dyeing process. The removal of the dissolved air is to avoid any oxidation of the coloring matter before dyeing takes place, and it is equally necessary to avoid any oxidation during the dyeing process. If this takes place, the dye precipitates and the coloring matter is deposited on the fabrics in such a condition that it rubs off very easily. After the goods are lifted out of the vat and oxidized in the air, they are thoroughly rinsed with water. The wet goods must be dried at once at a moderate heat. Overheating should be avoided, as it darkens the shade. If this happens a slight steaming will correct this fault. In order to increase the luster of the dried goods, gentle stretching or wringing is resorted to.

The dyeing of acetate silk involves entirely different technology than the dyeing of the other artificial silks. Basic dyes appear to have considerable affinity for the silk, especially in the presence of the chlorides of sodium, zinc and magnesium. Certain hydroxyazo compounds, as Alizarine Yellow R, can also be used. The surface of the acetate silk is sometimes covered with a layer of regenerated cellulose in order to increase the affinity of the fiber for the dye. The fibers that lie on the surface are actually deacetylated in this process and changed back into cellulose. A new class of dyestuffs, known as ionamines (see British Patents 7980, 23,543, 9792 and 25,989 of 1922), have been developed which are specially suited to the dyeing of acetate of silk. The dye is absorbed by the fiber in the partially developed state, and then the real color is brought out by diazotization and coupling. All sorts of hues and shades can be obtained.

Foreign Dyes Imported Through the Port of New York During August

Including Synthetic Chemicals, Medicinals, Photographic Chemicals, Intermediates, and Other Coal-Tar Products Classified by the Tariff Act of 1922 Under Paragraphs 27 and 28

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce, in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS FOR FOREIGN MANUFACTURERS

1—The Six Leading German Companies

A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873. Branches in France and Russia.
B—Badische Anilin-und Soda-Fabrik, Ludwigshafen on the Rhine. Founded 1865. Branches in France and Russia.
By—Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen on the Rhine. Founded 1862. Branches in France and Russia.
C—Leopold Cassella & Co., Frankfort on the Main. Founded 1870. Branches in France and Russia.
K—Kalle & Co., A. G., Biebrich on the Rhine. Founded 1870. Branches in Russia.
M—Farbwerke vorm. Meister Lucius & Bruning, Hochst on the Main. Founded 1862. Branches in France and Russia.

2—The Seven Smaller German Companies

BK—Leipziger Anilinfabrik Beyer & Kegel, Furstenberg near Leipzig. Founded 1882.
GG—Chemikalienwerk Greishem G.m.b.H., Griesheim on the Main. Founded 1881.
CJ—Carl Jager G.m.b.H., Anilinfarbenfabrik, Dusseldorf. Founded 1823.
GrE—Chemische Fabrik Griesheim-Electron, Offenbach on the Main. Founded 1842.
L—Farbwerk Muhlheim vorm. A. Leonhardt & Co., Muhlheim on the Main. Founded 1879. Branch in France.
tM—Chemische Fabriken vorm. Weiler ter Meer, Uerdingen on the Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—Dutch, Belgian and French Companies

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888.
NF—Niederlandische Farbe-und Chemikalienfabrik Delft, Netherlands (Delft). Founded 1897. Branch in Russia.
LG—Lazard Godchaux, of Brussels. (These products are probably compounded largely from the dyes made by A. Wiescher & Co., of Haeren, Belgium.)
P—Societe Anonyme des Matieres colorantes et produits chimiques St. Denis (formerly A. Poirrier), St. Denis, near Paris, France. Founded 1830.

4—Swiss Companies (all at Basel)

DH—Farbwerke vorm. L. Durand, Huguenin & Co. Founded 1871. Branches in Germany and France.
G—Aniilinfarben-und Extract-Fabriken vorm. Joh. Rud. Geigy. Founded 1764. Branches in France, Germany and Russia.
I—Geselfschaft fur chemische Industrie. Founded 1885. Branch in France.
S—Chemische Fabrik vorm. Sandoz & Co. Founded 1887.

5—English Companies

BAC—The British Alizarin Co., Ltd. Established 1882.
ClCo—The Clayton Aniline Co., Ltd., Clayton, near Manchester Founded 1876.
CR—Clauss & Co. (formerly Clauss & Ree), Clayton, near Manchester. Founded 1890.
CV—Colne Vale Chemical Co., Milnsbridge, near Huddersfield.
RHS—Read Holliday & Sons, Ltd., Huddersfield. Founded 1820. (Purchases by British Dyes, Ltd.)
BD—British Dyes, Ltd. Founded 1915.
Lev—Levinstein, Ltd., Crumpsall Vale, near Manchester. Founded 1864.
Q—Importations of unknown source, through dealers in colors.

THE imports of coal-tar dyes for August totaled 178,164 pounds, with an invoice value of $194,164. The following table shows the monthly imports through the port of New York for the year 1923:

Month	Pounds	Value
January*	179,309	$185,344
February	191,709	199,690
March	312,809	301,436
April	242,022	256,751
May	261,869	292,340
June	247,174	257,803
July	144,687	142,428

*Not complete.

The five dyes leading in quantity imported were Indanthrene Blue 3G, Gallamine Blue, Indanthrene Green B, Alizarine Synthetic and Rhodamine 6G. Of the total quantity imported in August, 1923, 52 per cent came from Germany, 35 per cent from Switzerland, 11 per cent from Italy and 2 per cent from other countries.

The dyes in this report are grouped by Schultz numbers, and in the case of those which could not be identified by Schultz number the classification according to ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced to a single-strength basis.

The designation "†" for competitive and "" for non-competitive in column 1 indicates the appraisement basis for the assessment of the ad valorem duty in paragraph 28 of the Tariff Act of 1922. Those dyes without designation are doubtful, pending further investigations.*

The ad valorem rate for competitive dyes is based on the American selling price as defined in Subdivision (f) of Section 402 of Title IV; the ad valorem rate for non-competitive dyes is based on the United States value as defined in Subdivision (d) of Section 402 of Title IV of the Tariff Act of 1922.

The imports of color lakes for August totaled 4,057 pounds with an invoice value of $2,881. The imports of synthetic aromatic chemicals for August totaled 5,180 pounds with an invoice value of $11,402, and the imports of medicinals, photographic developers and other coal-tar chemicals totaled 17,226 pounds with an invoice value of $24,404.

German Dye Production for July

In conjunction with the August statistics covering the imports of dyes, the following information, received by cable from Trade Commissioner F. E. Breithut, is rendered relative to the German production quantity in pounds of dyes for the month of July according to groups. In addition, the production is rendered according to factories:

I—Alizarine Red: May, 253,264; June, 209,035; July, 366,855.

II—Indigo Paste: May, 47,740; June, 576,400; July, 27,087.

III—Vat Colors except Indanthrene Blue GCD: May, 269,526; June, 236,385; July, 236,677.

IV—Indanthrene Blue GCD—May, 1,434; June, zero; July, zero.

V—Alizarine Colors other than Red: May, 172,753; June, 177,619; July, 140,516.

VI—Direct Colors for Cotton: May, 2,420,202; June, 2,750,097; July, 2,627,293.

VII—Direct Colors for Diazotization: May, 158,418; June, 281,221; July, 337,682.

VIII—Acid Colors for Wool: May, 1,405,122; June, 1,305,005; July, 1,487,790.

IX—Chrome Colors for Wool: May, 712,158; June, 709,799; July, 720,219.

X—Basic Colors: May, 300,916; June, 270,257; July, 325,653.

XI—Sulphur Colors: May, 1,567,896; June, 2,096,554; July, 2,522,978.

XII—Lake Colors: May, 144,663; June, 247,782; July, 239,536.

Total: May, 7,454,092; June, 8,862,154; July, 9,032,286.

	June (pounds)	July (pounds)
Barmen	29,251	61,283
Berlin	1,397,317	1,957,366
Beibrich	499,162	354,012
Dusseldorf	21,639	17,811
Frankfort	1,960,552	1,954,999
Greisheim	715,150	582,454
Hoechst	576,400	182,072
Leverkusen	3,089,680	3,129,438
Ludwigshafen	131,111	418,765
Mulheim	57,578	44,976
Uerdingen	384,314	327,967
	8,862,154	9,032,043

Note.—The difference in poundage (243) for the July total by groups as compared with July total by factories, is due perhaps to error in cable transmission.

The regular monthly import lists for August follow:

Schultz No.	Name of Dye and Manufacturer	Quantity (pounds)
121	Erica B	100
	Erica B Extra—(A)	
140	Curcumeine	4,178
	*Jasmine High Conc. 729—(G)	
207	Diphenyl Fast Brown	1,984
	*Diphenyl Fast Brown GNC—(G)	
220	Palatine Black	2,000
	†Wool Black GRF—(A)	
265	Sulphon Cyanine Black	4,409
	*Acid Milling Black B—(G)	
274	Diaminogene	2,156
	*Diaminogene Extra—(C)	
283	Bismarck Brown	40
	Bismarck Brown—(Q)	
308	Diazo Black	500
	*Diazo Black OT—(By)	
319	Diamine Scarlet	1,050
	*Diamine Scarlet 3B—(C)	
	†Chloramine Red 3B—(S)	
424	Chicago Blue 6B	2,107
	†Chloramine Sky Blue FF Conc.—(S)	
449	Trisulphon Brown	4,409
	*Trisulphon Brown B Conc.—(S)	

(*Continued on page 677*)

Fur Dyeing

Preliminary Operations—Dressing—Tanning—Drying—Killing—Mordanting—Dyeing—Dip Dyeing—Brush Dyeing—Fur Bases—Finishing—Drumming—Acid and Basic Dyestuffs—Dyeing Sheep Skins—Bleaching

By L. G. LAWRIE

A Paper Read Before the London Section, Society of Dyers and Colourists, and Published in the Journal of the Society

THE art of dyeing furs has been practised from the earliest historical times, and the mural paintings and other remains of the ancient Egyptians show that even at that early period they knew the use of vegetable substances for dyeing their furs.

The discovery of the use of organic bases for fur dyeing led to great progress in this industry. In 1888, E. Erdman patented the use of para-phenylenediamine and similar compounds for the dyeing of hair, and it was soon also used for the dyeing of furs, and about 1895 the Berlin Aniline Company introduced the first of the Ursol colors. These were principally diamines, amido-phenols, diphenylamine derivatives, etc., which possess the property of forming intensely colored insoluble compounds when treated with oxidizing agents.

The dyeing of furs is an important branch of the furriers' art. The natural color of many furs is not suitable for the market, and the required colors can only be obtained by artificial means. Then individual skins often vary considerably in color and marking, and before use they must be dyed to produce a more or less uniform shade on all the skins. Lastly, dyeing is resorted to in order to imitate the shades of more valuable furs on cheaper skins. This has been brought to a fine art. As examples of this type of imitation the following may be of interest—rabbit may be dyed to imitate sable and chinchilla, and when dyed and sheared, also to imitate seal or beaver; muskrat is dyed to imitate sable, and hare to imitate fox, etc.; in fact, nearly all the better and rarer furs can be imitated by the suitable treatment, such as dyeing, shearing, plucking, etc., of cheaper furs.

Preliminary Operations

The skins come into the market either as (1) "flat" or "open" skins, or as (2) "cased" skins, according to the way in which they have been removed from the animal. Flat skins are cut from the tail right down the center to the jaw and along the inner side of the legs. The skin thus comes off the animal in a more or less flat state. With cased skins the trapper cuts along the tail and across the body along the hind legs, the skin being then drawn off like a glove inside out. The reason for the two methods is that some skins are more satisfactorily handled in the subsequent manufacture when open and some when cased. The cased skins, of course, have to be turned flesh side out or fur side out, according to the nature of the process to which they are being subjected. After removal from the animal the skins are stretched out and allowed to dry and are then marketed. A few of the larger furs, such as bear and seal, are salted in addition to being dried. The drying process arrests the decomposition which would otherwise take place, but although the skins remain unchanged when dry, putrefaction sets in directly they become damp.

Fur Dressing

Before the furs can be used they must be dressed, the principal operation being a tannage to convert the skin into a soft durable leather, resistant to water.

The skins are first scraped and cleaned from adhering pieces of flesh, etc., and then softened by soaking in water; rabbit skins may be soaked for several days, while delicate skins like lamb will only stand a short soak. As putrefactive processes commence as soon as the skins become wet, an addition of salt, borax or formic acid is sometimes made, while with delicate furs, in place of soaking in water, damp sawdust may be spread over the flesh side. Soaking causes the skin to swell and become soft and pliable, but continued too long, the skin will become tender through putrefaction. After softening, the skins are subjected to a fleshing operation which removes the thin layer of flesh remaining on the skin.

Tanning

There are many ways in which this can be effected. The following methods are those usually employed:

1. *Pickle or Salt-acid Tan.*—This is a cheap and easy, but not very satisfactory method, and is used for skins which are to be dressed only, as they will not stand a subsequent dyeing operation. The skins are treated with a mixture of 5 to 10 per cent of salt and ½ per cent of sulphuric acid; the solution being either brushed on to the flesh side or the skins piled up and immersed. The skins swell up and the salt penetrates into the pelt, thereby keeping the fibers separated and producing a soft skin. A true tannage is not produced by this treatment, and the skin is only satisfactory if kept perfectly dry.

2. *Salt and Alum Tan.*—The skins are either immersed in a solution of 4 per cent alum and 1½ per cent salt or,

to prevent the tannage being taken up by the hair, the following paste is brushed on to the skin—4 pounds alum, 3 pounds salt, 4 pounds flour, and 6 gallons water. This tannage is decidedly better than the pickle, the skin having more stretch and elasticity; but it is removed to a certain extent by soaking in water, so that if the skins are subsequently dyed, a second tannage is required. Rabbit and mole skins are often tanned in this way.

3. *Chrome Tan.*—This tannage is only used to a limited extent, but the resulting leather has a very great resistance to water, even hot water, so that is can be dyed with acid dyes, etc. At the same time the leather is colored a bluish-green tint, which in some cases is objectionable.

The skins are stepped in a solution containing 5 pounds chrome alum in 10 gallons water for 2 hours at 70 deg. Cent.; 1½ pounds of soda crystals are then added slowly to the liquor and the skins are steeped overnight. They are then rinsed in water containing a little borax, and finally well washed.

4. *Oil Tan.*—This is one of the oldest, and probably the best and most used tannage, giving a good soft leather which stands the subsequent dyeing operation well. Seal oil is well rubbed into the skins on the flesh side and they are then folded up flesh to flesh and put into a tramping machine or "kicker"— a machine having two wooden hammers which pound the skins and work the oil into them. Formerly they were tramped by workmen treading them with their bare feet, and this method is still employed to some extent. After impregnation, the goods are allowed to "heat," and care must be taken that the temperature does not exceed 35 deg. Cent. If the skins are allowed to heat up too much the leather is spoiled, and if they do not heat sufficiently the skin is incompletely tanned. During this heating the oil oxidizes with the formation of aldehydes, which effect the tannage. If the tannage is insufficient, the process is repeated. Oils other than seal oil can be used, but they must be fish oils capable of absorbing oxygen from the air, such as whale oil or cod-liver oil.

5. *Formaldehyde Tan.*—For this tannage the skins are treated for several hours in a dilute solution of 40 per cent formaldehyde. It gives a good but "empty" tannage, not so satisfactory as the oil tan, but it is easy, cheap and rapid, and the skins are to a certain extent immune from the attack of vermin and moths. The resulting pelt is left white as against the dull buff shade of the oil-tanned skin.

Drying

After tanning the skins are dried, and great care must be taken to prevent them becoming hard and stiff. The drying should be rapid and uniform, and the more moisture the skins contain the lower the temperature must be, wet skins being very sensitive to heat. Hot-air dryers are generally used and the temperature should not be above 30 deg. Cent. to commence with, and should not reach above 45 deg. Cent. with wet skins.

The furs can now either be "finished" or left until required for the dyeing process, before which three more operations are necessary. These are (1) wetting out, (2) killing, and (3) mordanting.

Wetting Out is effected by steeping the furs in warm water, the temperature varying considerably according to the nature and condition of the skins.

Killing

This has a great influence on the actual dyeing process. The fur is treated with alkaline agents, such as ammonia, soda, lime or even caustic soda of varying strength, according to the nature of the fur. Hair, unlike wool, is very resistant to the action of dye solutions, and without an alkaline treatment it would not take up the dyestuff evenly, this being especially noticeable with the tips of the hair. This resistance is due partly to a coating of fatty materials which surrounds the hair and which has not been removed by the previous operations and partly to the hard horny nature of the hair itself; but that it is not entirely due to the oil or fat is shown by the fact that thorough extraction of the hair with benzene, petrol, ether, etc., is not sufficient to properly "kill" the hair. An examination of the hair under the microscope before and after the killing operation shows that the alkaline treatment opens up the scales and the fibers become more transparent.

If the tips of the hair require special killing, as in cases where they are very hard and resistant to the dye solutions, the furs are "brush" killed, but if the whole fur can be treated equally, they are "drum" killed.

Brush Killing is effected by brushing the alkaline solutions on to the hair, which is left being brushed off with a stiff brush. With *Drum Killing* the skins are immersed in one or other of the following cold solutions for from 2 to 3 hours—a 1 per cent solution of ammonia; a 1 per cent solution of sodium carbonate; a 1 per cent solution of freshly slaked lime; or a solution of ½ to 2½ per cent caustic soda (76 deg. Tw.). After steeping in the solution the skins are well washed and sometimes acidified (especially if caustic soda has been used) in a dilute solution of acetic acid. Often a combination of the two processes is used—the tips of the fur being killed by brushing on a strong alkaline solution and the whole skins being afterwards drum killed with a weaker alkali.

Brush Killing with Caustic Soda

The tips of the furs are brushed with a solution of caustic soda 2 deg. to 12 deg. Tw., according to the nature of the hair. They are then bundled hair to hair and left for from 3 to 8 hours, after which they are dried and the caustic soda brushed out. Afterwards they are generally given a drum killing in one of the above-mentioned solutions.

Brush Killing with Hydrogen Peroxide

The furs can also be brushed with a solution containing a 40 to 50 per cent solution of hydrogen peroxide

(12 vol.) and 5 to 6 per cent ammonia (0.88), and this not only effects a killing action on the hair, but it also both kills and bleaches dark bristly hairs.

Mordanting

All furs, except those to be dyed very light shades, are subjected to a mordanting process. Fur bases dyed on a copper mordant show, as a rule, a very much greater fastness to light than the same bases dyed on other mordants or on unmordanted fur. Further varying shades can be obtained from the one fur base by varying the mordant and additional variation by mixing mordants together. The principal mordants used are copper sulphate, sodium bichromate, ferrous sulphate, and alum. The part played by these mordants in fur dyeing is only incompletely understood. The metallic salts are dissociated in solution, and are taken up by the fur fiber with the ultimate formation of metallic oxides, hydroxides, or basic salts. Thus potassium bichromate is absorbed by the fur as chromic acid, and this undergoes decomposition in the dye bath with the formation of chromic oxide or hydroxide. But it is very probable that the main action of these metallic salts is not as a mordant, but either as an oxidizing agent or as a catalyst for the oxidation of the fur base by hydrogen peroxide. The fact that different shades may be produced from the same base when using different mordants may be due to the fact that their catalytic action influences the oxidation along different lines and so produces varying end products, and the fact that a considerable variation in quantity of mordant is permissible without materially affecting the shade tends to support this view. At the same time it is not impossible that these mordants also act in a manner analogous to the mordants on wool and that the metal actually enters into combination with the fur base.

The fur is mordanted by immersing for several hours or overnight in a cold solution of the mordant, together with an addition of 1½ to 3 ounces acetic acid (30 per cent) or 3 ounces tartar, per 10 gallons liquor, the latter causing a slower and more even dissociation of the mordant. The time of mordanting varies with the strength of the solution, larger amounts of mordant requiring a shorter time. The following are the usual strengths of the mordanting baths—4 ounces potassium or sodium bichromate, 8 ounces copper sulphate, 4 ounces ferrous sulphate, or 1 pound alum; in each case per 10 gallons of water.

The above mordants can all be mixed together with the exception of bichromate and ferrous sulphate.

Combined Killing and Mordanting Agents

It is possible to use mixtures of metallic salts with alkalis to form combined killing and mordanting agents: such as alum and soda ash; chromium acetate and caustic soda; or ferrous sulphate and ammonia. This substitutes one operation for two, but the solutions are very alkaline, and as mordanting requires a much longer time than killing, delicate furs will not stand the combined process.

After mordanting, the skins are rinsed to remove excess of mordant and then dyed. If they are not to be dyed immediately they must be kept in a moist state.

For the production of black shades, a copper mordant is generally used, while a chrome mordant is usually employed for browns and an iron or alum mordant for grays.

The following table shows the shades produced with some fur bases when using various mordants:

Fur Base (B.D.C.)	Unmordanted	Chrome	Copper	Iron
I	Dark brown black	Brown-black	Deep black	Black
III	Light brown	Dark reddish brown	Dull brown	Greenish-brown
VI	Dull yellow	Reddish-brown	Yellowish-brown	Dull yellow
VIII	Light gray	Reddish-gray	Neutral-gray	Neutral-gray
XI	Light gray	Light gray	Greenish-gray	Bluish-gray

Dyeing

The Berlin Aniline Co. brought out the first of their Ursol colors—Ursols D, P and C—in 1895. These were followed shortly afterwards by the Furrol colors (Cassella), and the Nako colors (Meister, Lucius & Bruning). The number of bases put on the market was gradually increased and there were before the war something like 20 to 30 Ursul colors available, many of which were mixtures.

When first introduced the dyeings with the new bases were anything but satisfactory; the colors rubbed or brushed off after dyeing, the hair lost its luster, and the leather became hard and brittle. But satisfactory dyeing methods were gradually evolved, and in addition the bases themselves were considerably improved in purity. The fur bases of the British Dyestuffs Corporation have been brought to a state of exceptionally high purity.

The fastness of these dyes is an important point, exacting requirements as regards fastness to light, rubbing, wearing and storage being necessary.

The dyeing of furs is much more difficult than the dyeing of textile fibers. This is due to the lack of uniformity in the furs themselves, which vary according to the district from which the furs came, the season of the year when the animal was trapped, and the condition of the animal itself. All these factors may considerably alter the affinity of the fur for the dyestuff and, in addition, in the same skin different portions have different affinities for the dye, and often the under-hair or "wool" dyes a lighter or darker shade than does the top-hair.

There are two main methods of dyeing—(1) Dip Dyeing, when the skins are completely immersed in the dye-

bath, and (2) Brush Dyeing, when the dye solution is brushed on to the hair.

Dip Dyeing

Most of the fur bases dissolve easily in boiling water, for Fur Base XI requires the addition of a little hydrochloric acid to ensure solution. The solution of base is added to the slightly alkaline, acid or neutral dye bath, and an amount of hydrogen peroxide (12 vol.), 12 to 15 times that of the fur base, is added, and the mordanted furs entered cold or lukewarm. The furs are moved about in the bath for some time, until the solution has completely soaked into them, when they are left for from 6 to 24 hours, according to the shade. Deep shades, such as blacks, and dark browns, require from 12 to 24 hours for their full development, while light grays only require a few hours. It is better, however, when dyeing light shades to leave the furs in a dilute solution for several hours than to dye them for a shorter period in stronger solutions. After dyeing, the furs are washed and are then finished in the manner described later. It is very important that the washing should be thorough, as there is always an excess of fur base left in the dye bath in an incompletely oxidized form.

Brush Dyeing

This method of dyeing is sometimes necessary owing to the fragility of the skin, but more often brush dyeing is used in order to color the tips of the hair only or to color the tips differently after the whole skin has been dyed a ground shade. For instance, in the case of imitation skunks, the under-hair is first dyed a deep reddish-brown, the tips being subsequently dyed black by brushing on a solution of Fur Base I. A further use for brush dyeing is in touching up dyed skins and equalizing uneven results caused by variations in the fur. The concentration of the brushing solution is from 4 to 10 times that used for dip dyeing. Several brushings may be required, the fur being allowed to dry between each. If it is necessary for the dye to penetrate further down than the tips, the fur is beaten with the brush, which forces the dye solution down to the roots of the hair. In this way all the hair can be dyed, and the skin left unaffected.

The following is a typical formula for a brushing solution for black:

6 ozs. Fur Base I are dissolved in
1 gal. Water, cooled to 80 deg. Fahr., and immediately before use
6 lbs. Peroxide of hydrogen (12 vol.) are added.

This solution is brushed two or three times on to the fur, allowing to dry between each application.

Production of White Tips

When it is necessary to leave the tips of the hair white, they are brushed with a solution of paraffin wax in petrol. The skin is then dyed in the usual way and the paraffin wax removed by treatment with petrol or other solvent.

Fur Bases

Fur Base I (para-phenylenediamine) is used principally for black shades dyed from a neutral bath on a copper or copper and iron mordant; but it can also be dyed on unmordanted fur, when lighter and browner shades are produced. To obtain a full black the furs must be left in the dye bath overnight. The self-shade of this base is rather red, and to produce bluer shades a small addition of meta-toluylenediamine is made to the dye bath. A mixture of Fur Bases I and X also gives a bluer shade of black than Fur Base I alone. Fur Base I can be mixed with other bases to give varying shades, thus with pyrogallic acid useful brown shades are produced. *Example.*—Dye on a copper mordant with: :

8 ozs. Fur Base I.
7 lbs. Hydrogen peroxide (12 vol.).
10 gals. Water.
Time—24 hours. Shade—black.

Fur Base III.—This base gives reddish-brown shades on chrome mordanted fur when dyed from a slightly alkaline bath. It is largely used for the production of browns in conjunction with Fur Base I. The color develops quickly and the dyeing operation is usually complete in about 6 hours. *Example.*—Dye on chrome mordant with:

5 ozs. Fur Base III.
3 ozs. Ammonia (0.88).
4 lbs. Hydrogen peroxide (12 vol.).
10 gals. Water.
Time—6 hours. Shade—reddish-brown.

Fur Base VI.—The brown shade produced with this base is much yellower than the above and it is used principally for shading purposes. It is usually dyed on a chrome mordant from a slightly alkaline bath and the color develops quickly. In conjunction with Fur Base VII blue-gray shades are obtained, similar to blue fox, squirrel, etc.

Fur Base VIII.—On an iron or copper mordant this base gives light and dark greys from a slightly alkaline bath. It is sometimes used as a bottoming color for dyeing opossum-skunks. The color takes some little time to develop, light shades being dyed in 8 hours and dark gray in from 12 to 16 hours. It can be mixed with other bases to produce varying shades of gray. *Example.*—Dye on iron mordant with:

3 ozs. Fur Base VIII.
3 ozs. Ammonia (0.88).
2 lbs. Hydrogen peroxide (12 vol.).
10 gals. Water.
Time—8 hours. Shade—medium gray.

Fur Base X gives brownish shades when dyed alone, but its principal use is in mixtures with Fur Base I to produce bluer shades of black.

Fur Base XI.—This base gives greenish shades of grey on an iron mordant and is dyed from a slightly acid bath. It is the standard base for fast light grey shades. The color develops fairly quickly and dyeing is usually complete in about 6 hours. *Example.*—Dye on iron mordant with:

4 ozs. Fur Base XI.
1 oz. Hydrochloric acid (30 per cent).
3 lbs. Hydrogen peroxide (12 vol.).
10 gals. Water.
Time—6 hours. Shade—greenish-grey.

Finishing

This has the object of improving the leather and bringing out the full beauty of the fur. The first operation is an application of some fatty matter to the flesh side, when the furs are dry or slightly damp. One of the most usual methods of softening is by rubbing a little whale oil or seal oil into the flesh side, the oil being well worked into the leather; and if the skin has already been oil-tanned this treatment is all that is required to give them softness, flexibility and resistance to water. Other substances used are egg-yolk, glycerine, olive oil, castor oil, etc., or mixtures of these substances.

With alum-tanned skins, a considerable quantity of the original tanning substance is removed from the skin during dyeing, and before they are allowed to dry they must receive a finish which is in the nature of a retanning operation. The following mixture is applied to the flesh side of the skins with a brush and well worked into the leather—2 pounds salt, ½ pound aluminium sulphate, 1 pound glycerine, 1 ounce egg-yolk, 1 gallon water.

Stretching and Staking

After oiling, the skins are drawn in all directions over a semi-circular or curved blade which is let into a block of wood standing on trestle legs. This operation, which is analogous to the "staking" or "perching" of leather, gives the skins the maximum amount of stretch and causes them to become very pliable. With cased skins this operation is carried out by means of stretching irons which are inserted in the skin and then opened out.

Drumming

The drum is a large cylindrical vessel of wood, containing hardwood sawdust, etc. The drum revolves and causes the furs to tumble over and over and the sawdust is consequently forced through the hair of the fur. The rubbing action so produced removes any dyestuff which is incompletely fixed and thus prevents rubbing. At the same time the drumming cleans the fur, each hair becoming polished by the action of the sawdust. After drumming, the furs are placed in a revolving cage and tumbled for some time to remove the sawdust. Finally they are beaten, to raise the hair, brushed, combed, etc., and are then ready for making up.

Dyeing with Acid and Basic Dyestuffs

Bright shades can be obtained on some types of fur by means of acid or basic dyestuffs, but these shades are not so fast as those produced with fur bases, and in addition it is difficult to obtain the deep rich colors which are usually required on furs. They, however, are used for bright fancy shades. Before dyeing, the furs should be "killed" in the usual manner, but not mordanted.

Basic Dyestuffs.—Basic colors are dyed from a soap bath containing 3 to 9 ounces of neutral soap per 10 gallons water at a temperature not exceeding 40 deg. Cent. They can also be dyed from a bath containing no soap but acidulated with 3 to 5 ounces of acetic acid per 10 gallons liquor. In this latter case the shades obtained are heavier than those from a soap bath but they are not so fast to rubbing. Practically all the basic colors can be dyed by one or other of these two methods.

Acid Dyestuffs.—Furs can be dyed with acid colors from a bath containing sulphuric or formic acid equal to half the weight of dyestuff used together with four times as much Glauber salt as of dyestuff. The temperature of the bath should not be above 40 deg. Cent. The colors produced are mostly bright shades, and are useful only in special cases; but the fastness to rubbing of the acid colors is much superior to that of the basic dyes. Deeper shades can be obtained by using chrome-tanned skins and dyeing at about 65 deg. Cent.

The following colors are the most suitable for this purpose—*Yellows*—Acid Yellow 79210, Naphthol Yellow FY, Citronine R conc., Lissamine Yellow T, Metanil Yellow Y; *Oranges*—Orange GG, Acid Orange G; *Reds*—Croceine Scarlet 3B 91877K, Acid Scarlet R, Fast Red EAS, XL Carmoisine 6R, Azo Geranine B, Acid Magenta II, Eosine YS; *Violets*—Acid Violet 79446, Fast Acid Lilac BD, Coomassie Violet AV, Coomassie Violet R; *Blues*—Indigo Carmine X, Alizarine Celestol B, Lissamine Blue B, Disulphine Blue V; *Greens*—Acid Green G, Lissamine Green V conc. Lissamine Green B; *Grays*—Induline A, Induline 2B, Nigrosine SS.

Dyeing Sheep Skins

Chlorination.—Acid and basic colors can be used to a greater extent for the dyeing of sheep skins if these have been chlorinated, which process increases their

affinity for acid dyestuffs. A quantity of bleaching powder solution of 9 deg. Tw. is taken equal in weight to that of the skins to be chlorinated, together with 10 per cent hydrochloric acid (calculated on the weight of skins). One-third of the above quantities are added to the bath and the skins are worked for 20 minutes in this solution, a third more is added, and the skins worked a further 20 minutes and finally they are worked for 20 minutes longer, after adding the remainder of the bleaching powder and acid. The bath is kept cold throughout the treatment. The skins are lifted out and well washed when they are ready for dyeing.

Other Dyeing Methods.—Furs are still dyed with vegetable dyes to a considerable extent, and Logwood is often used in conjunction with Fur Base I for the production of deep blacks.

Bleaching

Such furs as white fox, ermine, and sometimes white lamb, are frequently bleached, as only occasionally are these furs found perfectly white in the natural state. The two most usual bleaching agents are sulphurous acid and hydrogen peroxide. In the former case the damp furs are hung over wooden rods in a sulphur stove and left overnight, and are then thoroughly washed.

When bleaching with hydrogen peroxide, the furs are thoroughly soaked in a solution containing 3 per cent. hydrogen peroxide and 2 per cent ammonia, and then hung up to dry without washing. This treatment can be repeated if necessary until the desired bleaching action is obtained. The furs are then well washed and dried.

Discussion

S. Verrinder asked what advantages chrome tanning had over other tannages in the dyeing of furs.

The lecturer said that chrome tanned material could be dyed at fairly high temperatures. Usually oil tannage was preferred in the trade.

C. G. H. Shrimshire asked whether natural dyes—e. g., Logwood and Turmeric—were still used in fur dyeing. They appear to have certain advantages over synthetic dyes.

The lecturer replied that natural dyes were outside the scope of the lecture, but they were still largely used.

In reply to A. J. Carter, the lecturer said that the advantage of chlorinating fur tips by brushing was that the process caused the tips to absorb more readily acid and basic colors.

In reply to J. T. Jackson, the lecturer said that oil tanned skins were always drummed before dyeing. Alizarine and anthracene colors are rarely used.

F. W. Lake asked whether, since the mixing of bases did not always give the results one would expect from the shades given by the individual bases, could one rely on the result by applying one base after the other had been thoroughly oxidized.

The lecturer said the result could only be determined by experiment.

Mr. Hicks said that cases had come under his notice in which dermatitis has been attributed to the wearing of dyed furs. Should dyed furs yield anything to warm water on rinsing?

Another member also mentioned a case in which dermatitis was attributed to a dyed fur. This fur on examination was found to contain no matter soluble in water and no free base, but there was a certain amount of matter soluble in alcohol.

F. W. Walker asked whether the lecturer could not suggest some method of removing loose color from dyed furs so that such furs could be guaranteed harmless.

The lecturer said that if the bases were well oxidized and the furs were afterwards well drummed with sawdust there should be no color extracted by warm water, but for the prevention of loose color the best method was to back-mordant with copper sulphate before drumming with sawdust. Certain people were very susceptible to skin eczema, but most could wear dyed furs for a long period without suffering any ill-effects.

INCREASED ACTIVITY IN FRENCH TEXTILE INDUSTRY

French textile conditions are more satisfactory. After a disappointing spring there has been a recovery in retail sales of light textiles. Exports have also been stimulated by the depreciated exchange.

Stocks of raw cotton warehoused at Havre on August 2 amounted to 45,000 bales, of which 31,000 bales were American, compared with 63,000 bales on June 29, which included 47,000 bales of American. Stocks afloat for Havre on August 2 totaled 10,400 bales, of which 10,000 were from the United States. This was a slight decline from the previous month's total of 14,000 bales, of which 13,000 bales were American. The amount warehoused at other continental ports aggregated 140,000 bales, of which 118,000 were of American origin, and the bales afloat for these ports amounted to 26,000, 25,000 being from the United States. The warehoused stocks have decreased from 145,000 bales (including 92,000 American) on June 29, while the bales afloat showed a marked decline from the total of 157,000 bales, of which 70,000 were American, reported the previous month.

Sagging prices of raw cotton are causing spinners to delay purchases, but the cotton-textile trade is good.

The calmness which prevailed in the combed-wool industry early in July has been replaced by an active demand (chiefly domestic, but also export) affecting all grades. Although this is usually a calm season, prices are firm, with a tendency upward. Merinos and fine crosses are especially wanted. The June produc-

tion of combing plants was well absorbed and spot stocks are low. The condition of the wool textile industry is generally healthy.

The flax market shows little animation but prices are steady. The crop in northern France and Belgium is good, but that of Normandy has been somewhat damaged. There were no purchases of Russian flax because of the rise of sterling exchange.

There is a seasonal inactivity in raw silk but prices are strengthening. Stocks are low and buying is gradually improving. Spinners are receiving fair demands but are delaying purchases, on account of the belief that there will be increased supplies of available raw silk. The trend of French styles toward mixtures, as well as political uncertainties and exchange depreciation, has also operated to retard buying. Silk mills are refusing commitments beyond September and their prospects are unfavorable, as crepe is the only active line. Some manufacturers are turning their attention to wool and artificial silk. The imports of the latter item during the first five months of 1923 were almost four times those of the corresponding period of 1921.

A commercial agreement signed July 28 by France and Italy, covering silk duties, is expected to help the production of French silk manufactures.—Commercial Attache Chester Lloyd Jones, Paris.

Modern Bleachery Engineering

Equipment of Ideal Plant—Storage and Material Handling—Value of Experience—Daily Program of a Plant—Finishing Sheetings—Variable Speed Motors

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(A Paper Contributed by the Textile Division for Presentation at a Meeting of the A. S. M. E.)

BEHIND the building and equipping of a mill stands the engineer, whose task it is to visualize the completed plant in his mind as the first procedure preparatory to the making of drawings, specifications, plans for erection and purchase of building materials and equipment. On the screen of his mind mental pictures of design, construction, erection and equipment will form and pass, showing the different stages of construction until operation is possible. Sketches and plans find their conception in these mental pictures, and in them is heralded the birth of every new enterprise.

Every stage of its mental building is scrutinized by his vision and weighed in the balance of his judgment and experience. His desire to produce a structure commanding in technique and suitability leads him to give the planning of the plant very intensive study, and in the imparting of his vision and judgment to paper he marshals all his skill that his plans may materialize in the erection and operation of a plant that will serve its purpose most completely.

The modern finishing plant is designed, built and equipped to allow for economical and successful operation, and when it is engineered with foresight it is not only commercially sound but technically correct in structure and suitability to the business.

The description of what might be termed an ideal plant, equipped with every labor-saving device and engineering achievement, will show what can be accomplished in producing large volumes of work with an unprecedented saving in time and man-power. The bleachery proper is a one-story building with basement having a story height of approximately twenty feet and a basement of twelve feet. The kiers and pits are located in the basement, extending above the first floor.

The basement floor is made with built-in drains and a surface that will resist the action of the acid used. The main floor of the building is made from the very best of hard-pine timber and plank, heavily creosoted. The framing carrying the reels is also made from the same material. The roof is made from concrete insulated with cork, and the room is well ventilated by a large monitor running the entire length of the building.

Storage and Material Handling

The handling of materials in this plant is of interest. The storage of chemicals and starch, etc., is in the basement, and these are received on the first-floor level and used on the mezzanine floor. All materials are handled on trailer trucks. A ramp is provided for handling material to the basement, and the elevator is large enough to handle a loaded truck to the mezzanine floor for distribution. The plant throughout is equipped with automatic plaiters for filling the kiers and pits.

Taking care of the water for bleaching is an item of great importance to the modern concern, and elaborate

filtering and purifying plants are considered among the first requisites for doing high-class work.

This branch of the industry is a most important one and extreme care must be given to the goods in every process. There are but few hard and fast rules that can be applied in the successful production of high-class work. In the bleaching of goods the bleacher can only be guided by the weight, feel, construction, and appearance of the goods, how they respond to treatment in the different operations, and whether they are to be marketed full white, dyed, printed, or napped.

In passing judgment he can only draw on his experience or that of others to guide him. Years of contact, observation and experience have left indelibly on his mind and memory the characteristic appearance of different classes of goods while under treatment. It is this he recalls when he is endeavoring to pursue the wisest and safest course. The feel of the goods is also a guide, and the sense of touch or feeling tells the man of experience just what his goods will stand. This knowledge cannot be imparted by the mere telling or reading of it. It can only come through close association and keen observation day in and day out in the actual processing of the goods.

Value of Experience

While a knowledge of chemistry is a decided asset to the bleacher, the student of bleaching must nevertheless bear in mind that in studying chemistry he must give intensive study and thought to the application of chemicals to cloth as used in its treatment. This cannot be obtained in any laboratory. It can only be got in the bleach house proper, and preferably in a good-sized plant doing a variety of goods under the guidance of an experienced bleacher.

The same thing holds true in finishing, only that the finisher must be guided in his judgment according to the different finished effects desired and demanded by the trade. Judging the amount of starch to get a certain feel in cloth, moisture in goods, type of calenders to use and how, are problems that the finisher must meet every day.

Dyeing and printing are still more complex on account of the numberless kinds of dyestuffs and pigments used, and shades and color effects wanted. Striking a shade cannot be figured on paper. When a dyer is given a shade to match he can only draw on his experience or that of others to guide him in his judgment. A few patches from the first batch must be taken usually before the right shade is struck, and only then is it safe to proceed with the bulk of the goods. The same thing is true of printing, only that a small length of cloth showing the entire design is taken to judge not only the color but the exactness of the application of the design

The fact will be appreciated that in making gray goods a snowy whiteness, dyeing them in delicate hues, or printing them in artistic and beautiful designs and producing the many finished effects the trade demands, great care must be exercised. Behind all these are the minds and combined skill of the organization and the men who are responsible for the products of their plant and their fame on the market. Many of the men who follow this industry are real artists in their respective crafts, their minds being storehouses of knowledge gleaned in the ripe fields of experience and of intangible value to their plant and employer.

In the grouping of units and the transportation of goods from one process to another, engineers and plant geniuses have employed rapid-transit methods that have made possible production heretofore unattainable. From the moment goods are sewed in a modern finishing plant they are practically never handled until they are completely finished and delivered to the putting-up room.

Daily Program of a Plant

Let us follow the daily program of a modern plant. Gray goods are usually processed, in five-ton lots, and if these weigh, for instance, four yards to the pound this will equal 20,000 yards. The goods are laid out and the ends of each piece are sewed on a power sewing machine. They are then passed through the singeing machine if it is deemed advisable to singe off the loose or superfluous fiber on the surface of the goods. Attached to each singer is a small water box or trough so that when the goods leave the last flame they are passed through water on their passage to the gray bins. This eliminates the danger of scorching or burning the goods.

Liming and filling of the lime kiers are done the first thing in the morning, as also is the emptying of the kiers of the previous night's boiling. The lime-boiled goods are washed and soured, and later in the same day are returned to the kiers for soda boiling that night.

The soda boils of the previous night are washed, chemicked and plaited into the chemic bins to lie overnight. The chemics of the previous day are washed and soured and passed through pilers directly into the final washings and placed into the finished bins. In the modern plant all the equipment and machinery is so placed that as the goods proceed down the length of the house they are heading forward all the time toward completion. Here are seen endless chains of cloth passing in and out of the kiers, from and to the washers, into and out of the sour and chemic bins, into and out of the finished bins, with intermediate washings between every process.

Where the machinery used in bleaching might not be considered spectacular, it is a most pleasing sight to see thousands upon thousands of yards of cloth passing from one process to another, to view it in the gray, to watch it respond to treatment, and to view it piled in the wet-finished bins in huge masses of snowy whiteness.

Goods upon leaving the finished bins will pass directly to the scutcher to be opened out to their full width as they pass directly into the mangles and drying units. Here they are treated according to whether they are to be finished white, dyed, printed or napped.

Finishing Sheetings

Let us follow the finishing of such goods as sheetings. These goods will leave the white pits and pass directly through a scutcher into a combination water and starch mangle—if for pure starching directly into a weft straightener and forty-foot tenter—and over a large dry-can set and then be folded into trucks. If for back filling the goods will pass through a water mangle, over a small dry-can set, into a Scotch mangle, directly into a forty-foot tenter and over a large dry-can set and then be folded into trucks.

These rapidly moving units are never stopped from starting to stopping time unless some mishap occurs such as through the breaking of a seam, etc., and are speeded to deliver an enormous yardage. The cloth is automatically guided into these units by Foxwell guiders, which are operated by compressed air. This work was formerly done by two women sitting at the entering end of the frame who fed and guided the cloth by hand into the clips.

These units are driven by direct-current variable-speed motors having a speed ratio of three to one, all under push-button control.

Variable Speed Motor

The use of electricity and variable-speed motors has done much for this end of the business, and the engineer has done much to insure their application and success in operation. Synchronization of grouped units stands out as one of the most scientific innovations of recent times. In this a push button controls all the motors, so that all of the machines in the unit can be started or stopped simultaneouslly.

Each machine in the unit is equipped with a rheostat control so that they may be run together. The dancer roll, which controls the tension of the cloth, is connected with a rheostat which itself regulates the speed of the motor. As the cloth pulls tighter between any of the machines in the unit, the motor is caused to speed up through the actuation of the motor rheostat. In this manner the cloth is kept under control at all times.

After drying the goods are dampened by passing them through an atomizer as a preparatory processing to calendering. The dampened roll is then taken to the unrolling machine placed back of the calender. The cloth is run through a five-roll machine, from which it goes to a scray or trickle and then to the double doubler which is run in connection with the calender. This machine doubles the cloth to one-quarter of its original width in two stages, and then plaits it into a truck. This machine is also equipped with Foxwell guiders for feeding the cloth, and both the calender and the doubler are driven by direct-current variable-speed motors.

The cloth which is to be made into sheets and pillow cases is then taken to the tearing tables, where it is torn into the desired lengths. It is then distributed to the various sewing tables. For pillow cases there are two sewing processes, and for the ordinary wide sheeting, three, after which the individual shtets are folded and placed in trucks. The folded sheets and pillow cases are then taken to the laundry mangles, where they are pressed, and later parceled and put into the storage racks.

New Effects in Mercerization

STRONG mercerizing effects are obtained by immersing cotton fabrics in hot calcium thiocyanate solution, but the treatment gives the goods a harsh handle.

The object of an improvement patented (B. P. 196,696) by the O. P. A. and Dr. E. A. Fourneaux is to secure the advantages of the treatment while avoiding its disadvantages.

In carrying the improvement into effect, in one convenient manner, calcium thiocyanate solutions capable of dissolving cellulose are used, such as neutral or slightly acid solutions of such concentration as to boil between about 128 to 150 deg. Cent., but preferably nearer the lower point. Working within these limits, the temperature may vary between 90 and 130 deg. Cent., as concentration, temperature and time are more or less interdependent. Mixtures of solutions of calcium thiocyanate with solutions of other neutral salts may be used, providing they are capable of dissolving cellulose but in general the effect obtained with such mixtures is less satisfactory than that obtained with calcium thiocyanate solutions. The alkali mercerizing is carried out in the usual manner, with or without tension. If desired, the calcium thiocyanate solutions may be partly or entirely replaced by solutions of other thiocyanates or mixtures of thiocyanates known to be solvents of cellulose.

If a calcium thiocyanate solution be employed which boils between 120 and 128 deg. Cent., or if the temperature be kept between 60 and 90 deg. Cent., with solutions boiling between 128 and 150 deg. Cent., partial effects only are obtained from the treatment, but these effects may have commercial value.

Some Examples

1. The fabric is mercerized with alkali with tension, washed and dried, then treated at 110 deg. Cent. with calcium thiocyanate solution (boiling point 130 deg. Cent.). The time required to obtain the desired results depends to some extent upon the character of the fabric, and may be from a few seconds, say seven to ten seconds, and one minute. The fabric is then washed with or without tension, or the tension may be applied immediately

after washing and before drying. The effect obtained is a lustrous, soft and elastic permanent finish which becomes harder on more prolonged treatment.

2. The fabric treated as per Example 1 is mercerized a second time with alkali, with or without tension. The effect produced is a smooth, lustrous and transparent permanent finish which is stiff, without being hard or harsh.

If desired, the alternate alkali and thiocyanate treatments may be repeated.

In another application the fabric after mercerization with alkali in the ordinary manner is impregnated with calcium thiocyanate solution of suitable concentration, and then passed through an atmosphere of hot steam, vapor, or air in which the reaction of the calcium thiocyanate upon the cellulose is completed. The fabric is then washed and, if desired, dried; or wash, if desired, dried and mercerized with alkali in the ordinary manner and again dried. With this process, impregnation can be performed rapidly as in ordinary padding as the reaction is completed by exposing the wet fabric to heat. The calcium thiocyanate solution may be used hot or cold. The concentration of the solution used will depend upon the fabric itself, the amount of solution it retains at the time it is exposed to the heated atmosphere, and the amount of drying which takes place during such heating.

Printing Effects

In a further application the fabric after being mercerized with alkali, preferably with tension, is printed or padded in the usual manner with a printing paste, consisting of a concentrated solution of calcium thiocyanate with or without the addition of coloring matters or pigments, in which cellulose has been dissolved. A calcium thiocyanate solution capable of dissolving cellulose is used, such as neutral or slightly acid solutions of such concentration as to boil between 130 and 150 deg. Cent.; the solution may be acidified by means of acetic acid (containing, for example, 4 per cent of acetic acid), or other suitable acid.

The amount of cellulose dissolved should give a solution of suitable consistency for printing. Before printing the paste may be diluted according to the depth of the engraving on the printing rollers, the degree of drying, if any, the effect required and the nature of the fabric.

The printed fabric is then subjected to heat in the presence of moisture. This may be accomplished in various ways. The fabric may be exposed to the action of steam or to the action of damp hot air or passed through a hot liquid boiling above the temperature required, that is, about 90 to 130 deg. Cent. For example, a concentrated calcium chloride solution or a weak acid solution such as 1 deg. Tw. hydrochloric acid may be used. Or the printed fabric may be dried first, and then exposed to the action of steam or damp hot air, but by this method care is required to prevent tendering. The effect of the heat in the presence of moisture is to modify the fiber of the printed parts in such a manner that it becomes glassy and transparent after the following mercerization with caustic alkali, and thus produces an ornamented fabric resembling a brocade.

The use of cellulose as the thickening agent in the printing paste enhances the effect due to the local action of thiocyanates in combination with the alkali mercerizing treatments and makes the effect more permanent.

The effects obtained may be enhanced by printing resists upon the fabric before the first alkali-treatment, after the first alkali treatment and/or before the second alkali treatment, or generally before and/or after any stage or stages in the complete process. If the fabric be subjected to one alkali treatment only, then the resist may be printed either before or after. The resist pastes may consist of starch paste, or solutions of gums or albumen to which may be added pigments and/or dyestuffs with or without their usual assistants and/or mordants.

Further Examples

3. The fabric is mercerized under tension, washed and dried. It is then printed with starch paste in those places where it is intended to produce a white resist, and with pastes containing colors in those places where it is intended to produce colored resist effects. Most of the colors in common use in calico printing are suitable for the process described in this example. The colors are developed or fixed by aging or steaming. The fabric, either printed with paste or with paste containing colors, is then treated with calcium thiocyanate solution as described in Example 1.

Alternatively, before the thiocyanate treatment the fabric may be washed or submitted to any of the customary after-treatments—e. g., fixation with tartar emetic, care being taken that these operations are conducted in such manner as to leave sufficient of the resisting agent—in the present instance starch—on the fiber.

The printed portions remain opaque and retain much of their mercerizing luster, especially if the starch has been removed by malting subsequent to the thiocyanate treatment, whereas the non-printed portions assume the typical finish described in Example 1.

4. Fabric treated according to Example 3 is mercerized a second time with alkali with or without tension, or alternatively the alkali may be applied by printing a pattern. For the purposes of this special process only those printing colors can be used which are suitable for the ordinary crimping process.

The printed portions of the fabric remain opaque and retain much of their mercerizing luster, the unprinted portions assume the finish described in Example 2 in those portions which have been treated with alkali, and in the portions which have not been treated with alkali they retain the finish described in Example 1.

5. The fabric is mercerized with alkali under tension, washed and dried. It is then printed with starch paste in those places where it is intended to produce a white resist, and with printing colors suitable for the ordinary crimping process. The colors are then developed by aging or steaming. The fabric is then printed with calcium thiocyanate solution in which cellulose has been dissolved, dried, subjected to heat in the presence of moisture, and mercerized.

Those parts which have been printed with thiocyanate assume a glassy and transparent aspect, except where the fabric has been printed with the white or colored resist.

6. A fine lawn fabric, made from Egyptian cotton yarn 90s warp, 120s weft, 27½ by 18¾ to the quarter-inch reed and pick, weight approximately 10 yards to the pound, is, after bleaching, mercerized with tension with caustic alkali of 45 deg. Tw. at 15½ deg. Cent. for seven seconds, washed and dried. It is then passed through a hot calcium thiocyanate solution for fifteen seconds at 105 deg. Cent. After being squeezed in the mangle, the fabric is washed in the open width and soured with sulphuric acid 2 deg. Tw. at 48 deg. Cent. for thirty seconds, washed, dried on a jig stenter and finished to 41 inches.

The effect obtained is a lustrous, soft and elastic permanent finish.

7. A Cheshire cloth made from American cotton 32s warp, 38s weft, 19 by 24 to the quarter-inch reed and pick, 36 inches wide, weight approximately 4 1-3 yards to the pound, is mercerized with tension as in Example 6, washed and dried. It is then passed through a hot calcium thiocyanate solution, boiling point 133 deg. Cent., time of immersion ten seconds, temperature 100 deg. Cent., squeezed in the mangle, and soured as described in 6, then dried on cans and finished to 36 inches.

The effect obtained is a lustrous, soft and elastic permanent finish. The fabric becomes much fuller to the feel, smooth and much more elastic, and therefore less liable to be crushed and frayed.

8. An organdie made from Egyptian cotton 110s warp, 130s weft, 22 by 21 to the quarter-inch reed and pick, 36 inches wide, is mercerized with tension as specified in 6, washed and dried, then passed through a calcium thiocyanate solution, boiling point 133 deg. Cent., time of immersion twelve seconds, temperature 105 deg. Cent. It is then washed in the open width and scoured as specified in 6, mangled, and without drying mercerized again with tension as specified in 6, washed and dried on a jig stenter.

The effect produced is a smooth, lustrous and transparent finish which is stiff without being hard or harsh.

9. The fabric described in 6 is mercerized, washed and dried. It is then slop padded with a cold calcium thiocyanate solution, boiling point 130 deg. Cent., the expression of the mangle being such that the fabric retains approximately its own weight of the solution. It is then aged without any previous drying at 110 deg. Cent. for four minutes, in such a manner that the cloth leaves the ager with approximately the same degree of dampness as it had on entering. The fabric is then washed in the open width, soured and dried on a jig stenter, as specified in 6.

10. A cloth made from American cotton 21s warp, 21s weft, 14 by 16½ to the quarter-inch reed and pick, 45 inches wide, weight approximately 3 yards to the pound, is mercerized without tension with caustic alkali at 50 deg. Tw. at 15½ deg. Cent., time of immersion seven minutes, washed and dried. It is then slop padded with thiocyanate solution, aged, washed, soured as specified in 9 and dried on cans.

11. Calcium thiocyanate solution, boiling point 135 deg. Cent., is stirred in the cold with cotton pulp at the rate of, say, 1 gram for 100 c.c. of the solution and then slowly heated to 100 deg. Cent., with constant stirring. The solution thus obtained is cooled back to 50 deg. Cent., when it should be of a consistency suitable for printing. Print on a mercerized cotton fabric and dry. Age five minutes at 110 deg. Cent., the condition of the steam being such that the printed part does not spread or run. Wash thoroughly in the open width, sour and then mercerize wet with tension, the mercerizing conditions being as specified in 8. Dry on cans and finish on the jig stenter.

12. Print mercerized cloth with a starch paste at the rate of, say, 2 pounds wheat starch to the gallon and dry. The fabric is then treated with calcium thiocyanate as specified in any of the examples above, and is afterwards mercerized or not.—Dyer & Calico Printer.

The downward tendency in the prices of textiles in American and British markets is causing anxiety to Czecho-Slovak manufacturers, since it is felt that any marked decline in such prices in the leading markets would again put them out of the running for some months.—Acting Commercial Attache H. Lawrence Groves, Prague.

It is estimated that this year's wool clip in Hungary will exceed last year's by nearly 1,000,000 kilos. Care has been taken in sheep breeding, with the result that not only has the yield increased but the quality has been improved. Price during May showed a considerable increase over those obtaining a year ago.—Vice-Consul Walter S. Reineck, Budapest.

As a result of the large demand from the United States, the surplus of the kapoc crop in Java is unusual, but the demand is so irregular that there is a constant and wide fluctuation in the price. As a rule this fluctuation is seasonal and is not entirely the result of the normal supply and demand. The 1922 crop is practically depleted and the crop of 1923 will not be gathered until September.—Consul Parker W. Buhrman, Soerabaya.

SWEDEN'S DEVELOPMENT AS A HOSIERY MARKET

CONSUL WALTER H. SHOLES, Goteborg

Sweden's remarkable development as a hosiery market during recent years is indicated by the trade returns for 1921—the latest year for which statistics are available. These returns show that Swedish hosiery imports in 1921 amounted to no less than 433,742 kilos, valued at $3,011,093, as compared with only 157,335 kilos, valued at $655,300, in 1913, which was a so-called normal year.

The amounts of imports of hosiery from the United States also has increased considerably during the last few years. Formerly Swedish imports of cotton and silk hosiery from this country were of such small proportions that as late as 1913 the United States was in the "other countries" class. By 1921, however, American hosiery exports had reached a total value of $177,000. Additional amounts, which ultimately reached Sweden via Denmark, brought this total up to at least $250,000.

As might be expected, Germany has been particularly successful in its exports of silk and wool goods to this market, furnishing in 1921 approximately half of all of the hosiery imported. It seems doubtful, however, whether Germany will be able to maintain its prominent position in this market, as its hosiery exports to Sweden have suffered a severe slump in recent months.

Swedish imports of hosiery during 1913 and 1921 are given in the following table:

Swedish Imports of Hosiery

Countries of Origin	1913 Kilos	1913 Value	1921 Kilos	1921 Value
Silk hosiery:				
Germany	5,555	$120,000	39,598	$791,960
Great Britain	2,344	50,000	4,156	83,120
United States	....	....	1,982	39,640
France	1,429	30,700	1,444	28,880
Switzerland	....	....	4,132	82,640
Denmark	661	14,000	5,112	102,240
Other countries	209	4,500	511	10,220
Total	10,198	219,200	56,935	1,138,700
Wool hosiery:				
Great Britain	54,167	172,500	126,087	693,478
Germany	18,989	61,500	72,549	399,020
United States	....	....	1,909	10,499
Denmark	1,881	6,000	13,965	76,807
Norway	....	....	1,310	7,205
Other countries	250	900	1,255	6,903
Total	75,287	240,900	217,075	1,193,912
Cotton hosiery:				
United States	....	....	29,984	127,432
Germany	69,024	185,000	95,457	405,693
Denmark	1,984	5,300	31,387	133,395
Great Britain	1,244	3,300	2,113	8,980
Other countries	598	1,600	791	3,361
Total	71,850	195,200	159,732	678,861

No comparable figures for 1922 are available, the Swedish classification of hosiery in the monthly reports including gloves, underwear and various other articles. The items comprising these totals are given for 1921 to afford an approximate idea of the share of stockings and socks in the totals for that year, and these are included with the totals for 1922 as follows:

Swedish Imports of Knit Goods

	1921 (kilos)	1922 (kilos)
SILK		
Knit goods (hosiery):		
Stockings and socks	*56,935	....
Gloves	2,751	....
Underwear	....	....
Other articles	42	....
Total	59,728	41,975
WOOL		
Knit goods (hosiery):		
Stockings and socks	217,075	....
Gloves	3,210	....
Underwear	9,533	....
Other articles	91,384	....
Total	321,202	448,543
COTTON		
Knit goods (hosiery):		
Stockings and socks	159,732	....
Gloves	40,301	....
Underwear	72,520	....
Other articles	30,122	....
Total	302,805	478,836

*This figure may include some underwear, and other knit goods of silk.

SWEDEN A GROWING MARKET FOR SILK HOSIERY

By far the most interesting feature of the development of the Swedish hosiery market has been the growth of the demand for silk hosiery. Sweden, because of its cold and damp climate in the past, has not been a good market for silk stockings. Silk hosiery, however, now occupies probably the principal place in Swedish hosiery imports. The 1921 silk-stocking values constituted more than a third of the total, and the 1922 figures are expected to exceed those of wool hosiery. American silk-hosiery manufacturers, there-

fore, may look to Sweden as an ever-widening market.

The Swedish textile industry at first was somewhat slow in appreciating the possibilities of the domestic market for silk stockings, and not until three or four years ago were serious efforts made to compete with the English, German and American products. Now, however, aided by a high customs duty of 30 crowns ($8.04) per kilo, which means about $4 a dozen for imported goods, the Swedish manufacturers are able to compete successfully in this important article of commerce.

Retail prices for men's silk hosiery range between 4 and 12 crowns ($1.07 to $3.20) a pair; for men's cotton hosiery, between 0.60 and 2 crowns ($0.16 to $0.55); and for men's woolen hosiery, between 1 and 5 crowns ($0.27 to $1.25). Retail prices for women's silk hosiery range between 7 and 25 crowns ($1.87 to $6.65) a pair; women's cotton hosiery, between 0.70 and 2.50 crowns ($0.19 to $0.67); and women's woolen hosiery, between 1.50 and 7.50 crowns ($0.40 to $2).

Demand for Woolen and Cotton Hosiery

Most of the wool hosiery found on this market is of domestic or English manufacture, although cheaper qualities are imported from Germany and Czecho-Slovakia.

Cotton hosiery in Sweden is largely supplied by the domestic industry. Only mercerized cotton hosiery and thin fancy qualities are being imported (mostly from Germany and Czecho-Slovakia), although Great Britain also exports some of the better qualities of women's mercerized hosiery. Men's mercerized cotton hosiery has no noteworthy market in Sweden.

Plain-colored hosiery is particularly in demand, and the bulk of the trade consists of black, brown, blue and gray.

Credit Terms of Interest to Prospective American Exporters

Prospective American exporters should be apprised of credit terms governing the hosiery trade. German, English and Swedish manufacturers, for instance, usually grant wholesale dealers of good repute thirty days' credit with 2½ per cent discount, and one-month datings are customary. English manufacturers generally sell only to wholesale houses and in sterling currency.

The Swelling of Cotton Cellulose

A Summary of the Literature

Swelling in Water—Swelling in Solutions of Acids—Swelling in Solutions of Alkalis—Swelling in Salt Solutions

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(References by number in parentheses relate to the Bibliography subjoined)

THE swelling of any substance in a fluid may be regarded as an extension into space, the system retaining rigidity, and may be measured by the ratio of the total volume occupied by the swollen substance and the medium interpenetrating it to the initial volume of the material. In the case of the cotton hair, there are two effects to be distinguished, namely, the true swelling as defined above, and the change of shape arising from the release of relatively gross mechanical stresses in the hair or due to the anisotropy associated with the existence of the lumen and of spiral fibrils (3). Until recently (191), (192) the necessity for such distinctions does not seem to have been indicated. The second effect is doubtless intimately bound up with the deconvolution of cotton hairs, and is plainly manifested in the rapid self-erection of a plug of compressed cotton when placed in water; while the decrease in length of cotton hairs when swelling can only be accounted for by structural considerations.

Quantitative observations bearing on the swelling of cotton cellulose have been published by relatively few workers, of whom the most important are: Willows, Barratt and Parker (192) and Willows and Alexander (191), on the changes in length and cross section of single hairs in solutions of sodium hydroxide; Justin Mueller (86), Knecht and Harrison (93), Krais (95), and Huebner and Pope (83), on yarns; Beadle and Stevens (6), (7), on the hydration in sodium hydroxide solutions of cellulose regenerated from copper ammonium hydroxide solution; Leighton (100), (101), on absorption in acid and alkaline solution; Coward and Spencer (25), on absorption of sodium hydroxide and water; Haller (65), on microscopic measurement of the swelling of single hairs; and Herzog (77), who investigated various artificial silks.

When swelling proceeds so far that the system loses its rigidity, solation is said to occur, and it has been con-

sidered advisable to include some references to the latter phenomenon.

Swelling in Water

Measurements of cotton hairs under the microscope (65) show that the amount of swelling depends to some extent on the variety of cotton. With a bleached American sample, an increase of 16 per cent in diameter was observed when air-dried hairs were immersed in cold water, and a decrease of 5.5 per cent on further drying of the air-dried cotton over sulphuric acid. All artificial silks swell considerably in water (71), and the following figures are due to Herzog (77), who states that the swelling is reversible:

Table I

	Kind of Silk			
	Cuprammonium Per Cent	Collodion (Lehner) Per Cent	Viscose Per Cent	Acetate Per Cent
Increase in Length	3.65	0.77	4.80	0.14
Increase in diameter from Cross Sections	31.75	17.8	28.8	0.6
Increase in diameter from Ribbon Width	38.5	38.7	53.2	0.0
Increase in area of Cross Section	61.8	45.2	65.9	5.7
Increase of Volume	67.8	46.4	73.9	6.0

A slight contraction varying with the temperature, occurs when a cotton yarn is immersed in water (86), and a decrease in total volume (80). Soaking in cold water for a week, or in hot water for a shorter period, makes the yarn more uniform in twist and strength (70).

From work on the extraction of cotton and other celluloses by water (42), (49), (80), (119), (141), (151), (165) it appears that the greater the modification of the cellulose the more easily is it swollen. Parchment paper may become soft and greasy on immersion (137), but is resistant even to boiling water (1). The products obtained by the action of sulphuric or nitric acids are sometimes dispersed by water (see below). When cellulosic materials are treated in the papermaker's beater they become more and more hydrated, swelling according to Briggs (13) and to Schwalbe and Becker (149). The more reactive materials are the most rapidly converted by this process, so that preliminary treatments with acid or oxidizing agents aid the process (149), (117). Steaming or prolonged heating with water is said to reduce the ability to swell (149). The swollen masses or "gels" dry to hard, horny products, which swell in a damp atmosphere (148) and suffer a reduction in water-absorbing power by preliminary heating (13), (148), (149). Tauss (163) claims to have produced gelatinization of Swedish filter paper, and only a slight modification by heating with water at 20 atmospheres pressure, while von Weimarn (186) concludes that under suitable conditions of temperature and pressure water will disperse cellulose.

The processes included under the term "Schreinering" (132) depend on the increase of plasticity consequent upon the swelling of the cotton cellulose in water vapor at elevated temperatures, and it has been proposed (160) to increase the strength of artificial cellulose fibers by the action of superheated steam at 105 to 120 deg. Cent.

Swelling in Solutions of Acids

Sulphuric Acid

There does not appear to be any record of swelling by dilute sulphuric acid save in the case of oxycellulose in 15 per cent acid (122). The direct action of the dilute acid or its action when obtained by diluting systems of cellulose and concentrated acid is to bring about modification of the cellulose to hydrocellulose, and degradation to cellulose dextrins, sugars and the like (5), (19), (20), (44), (56), (94), (98), (99), (116), (123), (130), (131), (156), (167), (169). As the concentration of the acid increases above 50 per cent, obvious swelling occurs followed later by solution. Girard (56) states that in 56 per cent acid cotton hairs rapidly expand and appear distended under the microscope after an hour, while Cramer (26) describes the phenomenon in moderately concentrated acid as being exactly parallel to the swelling in copper ammonium hydroxide solution. With 60 per cent acid there occur a rapid untwisting, a swelling, and a shortening of the hairs, which dissolve slowly in this acid, but more rapidly in more concentrated acid (83). Part of the cuticle, the so-called "cutin," does not appear to dissolve (116).

The use of acid of from 30 to 100 per cent has been suggested (126) for the momentary immersion of fabrics to increase their transparency, while 62 per cent is the concentration usually recommended for mercerizing (87), (108), (131) and preparing easily soluble forms of cellulose (53), (177). This acid has also been proposed for the after-treatment of artificial silk (4) and for obtaining a crepe effect without luster and parchmentizing on bleached mercerized fabrics (74); its swelling action may be slow and accompanied by considerable modification of the cellulose (17), (120). Cellulose is said to be parchmentized by 78 per cent acid in 10 to 30 seconds (153), not more than 15 seconds at 10 deg. Cent. being the time allowed technically (190).

Concentrated sulphuric acid seems to act like the 62 per cent acid, only more rapidly (84), (106), (116), (130) and with carbonization (44), (130), (164), which, however, is slow in the case of pure cellulose (88). The concentrated acid also appears to swell and dissolve all artificial silks (71), (76) and *B*-oxy-cellulose (29), (45), (62).

Amyloid is the precipitate obtained on adding a considerable amount of water to a fresh solution of cellulose in 56 per cent or more concentrated acid, but much of this precipitate goes back into solution on washing with water (18), (44), (131), (152), (153). The cellulose appears to be modified to form hydro cellulose (17), (18), (56), (120). Bechamp (8) has classified the products obtained from cellulose by the action of sulphuric acid from different periods of time as follows (i) the dissolved or swollen cellulose recovered as a gel, insoluble in hot and cold water; (ii) a gel soluble in cold water; (iii) cellulose dextrin; (iv) sugars. To obtain products peptized by water it is necessary to treat the material for a period of time varying with its nature and the concentration of acid employed (8), (17), (44), (61), (152), (153).

Adsorption in sulphuric acid solutions has been studied by Leighton (101).

Cellulose treated with a solution of sulphuric acid in acetic acid and washed with water tends to gelantinize (84).

Hydrochloric Acid.

Solutions containing less than 35 per cent acid produce hydrolytic degradation of the cellulose or formation of hydrocellulose (19), (34), (44), (56), (157), (181), (194), (197). The concentrated acid caused a rapid untwisting of the cotton hairs and slight swelling (83), the cellulose taking up less water than in sulphuric and phosphoric acids (101). Between 36.3 per cent and 37.2 per cent the cotton is mercerized, from 37.2 per cent to 38.4 per cent it is rendered swollen and transparent, while 38.9 per cent and more concentrated acid gelatinize and dissolve it, the solated material becoming degraded with time (8), (91), (193), (194). Dry hydrochloric acid gas is said to act upon cellulose and produce a friable substance (154), and a saturated solution in carbon tetrachloride carbonizes cellulose (59). Mixtures of hydrochloric and other acids, such as sulphuric and phosphoric, have been recommended as solvents for cellulose (32), (121), (127), (128), (129), (157), (199).

Nitric Acid.

Dilute nitric acid appears to have little action on cellulose, even when heated (48), (139), though the formation of hydrocellulose (73) and of oxyloidins of low nitrogen content are mentioned (85). Hot 47.5 per cent acid produces a substance which, on washing with water, becomes gelatinous and then peptizes, so that organic solvents are required to wash out the nitric acid. While wet, this product is easily peptized by dilute alkaline solutions, concentrated alkaline solutions coagulating the sols, but drying reduces the facility of sol formation (41), (45), (62), (73), (103), (124), (136), (142).

A similar action is exerted by 60 per cent acid though more oxalic acid is produced as a by-product (15), (29). 65.3 per cent acid at the boil is said to dissolve viscose silk (162); 67.5 to 74.4 per cent acids are given as suitable for mercerization (55), (89), (144), though oxycellulose is said to be formed (93); 68.6 per cent acid gelatinizes cotton, and water removes the acid from the product dried over lime, *in vacuo* (90); longer action (73), or more concentrated acid (90) causes nitration. Cotton hairs immersed in 68.6 per cent acid suffer a rapid untwisting and also swelling, the latter less than with caustic soda (83). With 69.8 per cent acid, filter paper, after washing, becomes closer in texture, stronger, contracts about one-tenth, and contains no nitrogen (48). Girard (56) states that 70.7 per cent acid nitrates cellulose and yields a friable product, while 78.2 per cent acid nitrates after a time and yields a gummy mass. According to Haussermann (73) 77.3 to 80.9 per cent acids cause strong swelling, solation and nitration, more concentrated acids simply nitrating, though above 94.1 per cent a felting or parchmentizing effect is noticeable.

Mixtures of nitric and sulphuric acids have been described which do not nitrate cellulose (102) or only gelatinize it (183).

Other Acids.

Phosphoric acid, when concentrated, causes a very slow untwisting and swelling of cotton hairs with subsequent solation (83). The syrupy acid has no action according to Girard (56), whereas Mangin (106) states that the cold, concentrated acid causes the formation of hydrocellulose, followed by solution. Mixtures of sulphuric and phosphoric (97), acetic and phosphoric (35), (79), and formic and phosphoric acids have been suggested (176) for the solution of cellulose, in some cases with precautions to prevent degradation of scis.

Hydrobromic acid, in concentrated solution, dissolves cotton with decomposition (23), (121). According to Willstatter and Zechmeister (194), 48 per cent acid gelatinizes cotton, 57 per cent dissolves it incompletely, while 66 per cent completely dissolves it at 6 deg. Cent., giving a solution from which it can be recovered quantitatively. Concentrated solutions of *hydriodic acid* rapidly dissolve cellulose (35), while Girard's hydrocellulose (56) is said only to be swollen by 24.5 per cent acid. *Hydrofluoric acid,* in aqueous solution from 5 to 30 per cent, has little effect, whereas more concentrated acid causes destructive hydrolysis (182); 70 to 75 per cent acid rapidly swells and dissolves cotton (194).

Acetic acid slightly swells cuprammonium silk, while *chromic acid* in semi-saturated solution dissolves it, though it does not attack cotton (72); 30 per cent chromic acid is said (162) to dissolve viscose silk.

Sulphur dioxide gas under pressure in the presence of water at 120 to 160 deg. Cent. dissolves cotton and is

recommended as a hydrolyzing agent for cellulose (40).

Deming finds (35) that *arsenic acid* slowly dissolves cellulose in the cold, readily when hot, and that hot *selenic acid* also dissolves cellulose.

Swelling in Solutions of Alkalis

Sodium Hydroxide.

The change in length of yarns and of single cotton hairs in solutions of sodium hydroxide has been studied by several observers, but no reliable estimate of the volume change can be made without more knowledge of changes in configuration occurring during swelling. Willows, Barratt and Parker (192) have determined the change in length of single cotton hairs under a load of 50 mgm. when immersed in single solutions of sodium hydroxide of different concentrations, and in a series of solutions of increasing and decreasing concentrations. Maximum contraction after three minutes immersion is found to occur at 13.3 per cent sodium hydroxide in the first case, and, in the second, although kiered, scoured and extracted hairs give similar isotherms, the amount of contraction increases in the order stated. Justin Mueller (86) similarly finds the order with yarns to be raw, waterboiled, and bleached, while an 18.7 per cent solution products the greatest contraction in 10 minutes. Huebner and Pope (83) get the maximum contraction at 20 per cent sodium hydroxide, and Knecht and Harrison (92), using hanks of yarn and washing, find it in 26 per cent solution. Krais (95) has carried out similar experiments, and states that the addition to the sodium hydroxide bath of many substances, such as salts and glucose, reduces shrinkage. All these observers agree that shrinkage is increased by decreasing the temperature. Both in water and dilute sodium hydroxide, yarns appear to contract while hairs extend.

The chance in cross section of cotton hairs on mercerizing has been examined by Willows and Alexander (189).

Leighton (100) states that in solutions containing up to 7 per cent sodium hydroxide each gram of cotton takes up 4.0 gram water, but at higher concentrations the amount of water is progressively reduced. Coward and Spencer (25) have determined the absorption at room temperature of water and sodium hydroxide over a wide range of concentration, basing their results like Leighton upon the performance of a centrifuge, whereby they refer to a mechanical and not necessarily a true thermodynamical equilibrium. It appears that a maximum absorption of water is reached with 14.3 per cent sodium hydroxide, but that the amount of the latter absorbed is proportional to its concentration in the solution. Beadle and Stevens (6), examining the swelling in sodium hydroxide solutions of cellulose regenerated from copper ammonium hydroxide solution, have determined absorption isotherms from which it appears that maximum absorption of water occurs near a concentration of 10 per cent at temperatures from 0 deg. to 40 deg. Cent. The same authors have shown (7) that the presence of sodium chloride considerably reduces the amount of water absorbed. Herzog and Beck (78) record with cellulose recovered from calcium thiocyanate solution, a maximum swelling in 10 per cent solutions of sodium hydroxide. The absorption of sodium hydroxide in the phenomenon of swelling appears to have attracted more attention in the literature than the absorption of the water (6), (7), (12), (28), (57), (81), (100), (109), (114), (167), (178), (179), (180), (188).

The structural changes resulting from the action of sodium hydroxide on cotton hairs have been investigated by a number of workers (67), (96), (104). The observations are not altogether concordant, but it appears that, when the necessary concentrations are employed, the hair walls are thickened, the lumen is partially or altogether filled up, and de-convolution occurs. The de-convolution has been studied by Tuebner and Pope (83), who find that if the concentration of sodium hydroxide does not exceed 11 per cent uncoiling alone occurs, while at 15.5 per cent this is followed by swelling; at 17.7 per cent the two proceed together, and at 27 to 36.3 per cent the swelling precedes untwisting. Immature hairs are said not to untwist in 18 per cent solution (64). According to Harrison (68) the shrinkage and untwisting of cotton hairs is due to release of stresses in the hair which are able to act on the more plastic material. Haller's statement (63), that the cuticle is removed, is denied by Minajeff (115), (116).

Treatment with sodium hydroxide solution of mercerizing concentration is frequently recommended as a method of bringing cellulose into a form which will dissolve easily in cellulose solvents (10), (11), (14), (33), (36), (46), (50), (51), (52), (99), (105), (138), (143), (165), (195), (199).

Potassium Hydroxide.

Dilute solutions of potassium hydroxide, like sodium hydroxide, cause losses to cellulosic materials, particularly at the boil, and when modified celluloses are present. In an 18.6 per cent solution, Haller (65) found a 20 per cent increase in the diameter of dry cotton hairs, and he considers (66) that in hot, concentrated potassium hydroxide solution the cuticle is merely removed and not dissolved. Mercerizing concentrations are given as 35 to 39 per cent at 4 to 8 deg. Cent. (87), and also as 13.8 to 29.8 per cent (167).

Artificial silks are said to swell but not dissolve in hot 4 per cent potassium hydroxide (76), and in cold (72) or hot (159) 40 per cent potassium hydroxide. According to Ristenpart (140), the mercerizing action of 1 mol of sodium hydroxide is equivalent to that of 1.5 mols of potassium hydroxide, though at high concentrations the comparative efficiency of the sodium hydroxide is reduced on account of the greater viscosity.

Alcoholic solutions of sodium and potassium hydroxides are said (47) to have no mercerizing action, but to yield hydrocellulose (106).

Other Alkalis.

Knecht and Harrison (92) have investigated the comparative shrinkage of yarn in solutions of the hydroxides of lithium, sodium, potassium, and tetramethylammonium, and found that the effect decreases in the order stated. Solutions of calcium, barium, and ammonium hydroxides and hydrazine hydrate have no effect.

Sodium Hydroxide and Carbon Disulphide.

If cellulose is treated with sodium hydroxide of mercerizing concentration, and while still containing water and alkali is mixed with carbon disulphide, further swelling takes place, and the mixture may be diluted with water or dilute alkali to form a sol from which a product known as viscose may be isolated. The carbon disulphide may be introduced as a liquid, as a vapor (16), or mixed with organic liquids (155), (169). The proportions of the reagents in the case of unmodified cellulose are said normally to be $IC_6H_{10}O_5$:2NaOH:ICS_2 and 30—40H_2O, and the product has been styled alkali-cellulose xanthate (31). In the case of cellulose subjected first to acid treatment (27), disintegration in the Plauson mill (145), or heating under certain condition (58), the reacting proportions may, however, become $2C_6H_{10}O_5$:2NaOH:ICS_2. That the product of the various reactions is not in equilibrium is shown by the change in the properties of the sols obtained, and for technical purposes maturing for a certain period must occur (107), (196).

Balls (2) uses 9 per cent sodium hydroxide and carbon disulphide to show optically the existence of daily growth rings in the cotton hair, fortyfold swelling being obtained with ripe hairs, while unripe hairs do not swell appreciably.

Copper Ammonium Hydroxide Solution.

This was first investigated by Cramer (26) in 1858, who found that swelling generally precedes solution unless the reagent is very concentrated. In the case of cotton, barrel-shaped formations arise, the cuticle which has been estimated as 10 per cent of the whole being unswollen and split off, the fragments assuming spiral or ring forms like wood shavings in appearance. The swollen portions are no longer bright in polarized light, but only the constricted portions, as has been confirmed by Harrison (69). Balls (2) has been able to show the existence of daily growth rings in the cell walls, apparently seen without interpretation by other observers (67), (115). "Beard" hairs (from the pointed end of the seed) swell but slowly in the solution, the cell wall being stratified into a number of well-differentiated layers (75). The youngest layer, that is, the portion of the hair closest to the inner cell wall, is the first attacked and dissolved (43). Unripe hairs do not swell appreciably (2), (75), or swell, but do not dissolve (64); and the protoplasm is not dissolved (75), (118).

Solation (161) is facilitated by such previous treatments as mercerizing and bleaching, and by using the product wet, the solubility of the cellulose varying with the treatment. The existence of several cellulose copper complexes has been suggested without any very strong evidence, and Traube has definitely formulated on chemical lines a theory of the solvent action (173), (174), but the whole subject is still obscure.

All artificial silks and modified celluloses swell and dissolve in copper ammonium hydroxide solution (35), (39), (71), (76), (121), (146), (162), (175).

The use of alkylamines and of alkyleneamines in aqueous solutions as solvents for copper salts or hydroxide, and hence of cellulose, has been protected, technical advantages being claimed (53), (54), (171), (172).

Solutions of other hydroxides in ammonia do not seem to be so efficient as those of copper hydroxide, but it appears that nickel ammonium hydroxide solutions dissolve cellulose, and, in exact analogy to copper ammonium hydroxide solutions, if excess nickelous hydroxide is present, this dissolves hydroxide solutions, if excess nickelous hydroxide is present, this dissolves when more cellulose is added (99). It is stated (31) that by the action of zinc on copper ammonium hydroxide cellulose sols the corresponding zinc-ammonium sols can be produced, though, according to Duyk (39), ammoniacal zinc hydroxide does not attack artificial silk.

Swelling in Salt Solutions

General Treatment.

There are four more or less systematic investigations and hypotheses of the action of salt solutions on cellulose, namely, those by von Weimarn, Herzog and Beck, Deming, and H. E. Williams.

According to von Weimarn (185), any salt solution under suitable conditions of temperature and pressure will disperse cellulose. Two stages are attained: (i) a gelatinous plastic condition, the material being transparent or semi-transparent, and (ii) the sol condition. The most efficient agents are those which most easily become hydrated and possess great solubility in water, such as the iodides of sodium, calcium, strontium and lithium, and the thiocyanates of barium, calcium, strontium and manganese. With other salts, peptization is slower; thus, with sodium chloride in concentrated solution at 170 deg. Cent., eight atmospheres pressure is necessary, and cooling or diluting coagulates the sols. Von Weimarn gives the following series obtained from unpublished results:

Complete swelling→ No appreciable swelling
$LiCl \rightarrow CaBr_2 \rightarrow SrBr_2 \rightarrow KI \rightarrow BaCl_2 \rightarrow NaCl$.

Schwalbe (147) denies that sodium chloride solutions can act as solvents for cellulose, and Herzog and Beck (78) likewise contend that only certain salt solutions possess solvent action, for negative results were obtained with solutions of chlorides, bromides, nitrates, thiocyanates, acetates, and lactates of sodium, potassium, ammonium and magnesium, and also with the bromides of barium and strontium, and barium thiocyanate. They conclude that von Weimarn's statement is incorrect, and

only applies with certain limitations. Against this, von Weimarn (186) reasserts his position, stating that Herzog and Beck have not explored all possible conditions of temperature and pressure. Herzog and Beck state that it follows from their experiments that the solubility of cellulose in concentrated salt solutions is a function of the degree of hydration of the ions, and increases with it. The solvent power of a salt follows therefore from the known series:

$NH_4 < K < Na < Li$; $Ba < Sr < Ca$; $\frac{1}{2}SO_4 < Cl < Br < 1 < CNS$.

They suggest as a working hypothesis that complexes of cellulose, salt, and water are first formed and later broken up by the adsorption of water by the carbohydrate.

Deming (35) supposes that the peptizing action of such solutions as zinc chloride is due to acid formed by hydrolysis of the salt. Using filter paper, he has discovered the solvent action of many solutions, such as cold, concentrated solutions of mercuric, stannous, and bismuth chlorides in concentrated hydrochloric acid; four parts of stannous chloride in one of water at 100 deg. Cent.; and mixtures of antimonic, stannic, or titanic chlorides with a little hydrochloric acid. With the last, the swelling is easily seen. Many other solutions and mixtures were examined and found to vary in efficiency. After dilution, all the sols coagulated on standing.

Williams (189), (190) studied chiefly the action of thiocyanates, and concludes that a salt solution to which no acid has been added must possess a certain boiling point, viscosity and heat of dilution, in order to effect direct solation. Apart from these physical requirements, Williams puts forward a theory of the mechanism of swelling and solation in which he particularizes Herzog and Beck's rather vague hypothesis. Salt solutions which are cellulose solvents possess a positive heat of dilution, that is, assuming hydration to be exothermic, the molecules or ions of the salts possess a water-combining power. The cellulose is similarly capable of combination in virtue of its hydroxyl groups. When the temperature rises, the water-salt complex tends to dissociate, and the freed water molecules migrate to the cellulose, causing further swelling.

Zinc Salts.

A 40 per cent solution of zinc chloride at a gentle heat gelatinizes cotton, and on further heating yields a homogeneous syrup (31), while in the cold at 50 per cent solution exercises but a slight untwisting and slow swelling action on single hairs (83). Mercerizing with a 59 per cent solution at 65 to 71 deg. Cent. has been recommended (108), and a crepon effect and a silky luster can be obtained on fabrics by printing with a 74 per cent solution, and drying at 40 to 50 deg. Cent. (60). Paper may be swollen and gelatinized with solutions of more than 60 per cent concentration (200). Technical application (14), (22), (36), (37), (46), (125), (170), (184), (198) of the solvent power of zinc salts has been made by various authors, additions of such agents as hydrochloric acid and formalin being sometimes made to the solution (30), (31), (190). When zinc chloride solutions dissolve cotton, all trace of the original structure and of the cuticle disappears (118), but non-aqueous solutions neither swell nor dissolve cellulose (35).

Iodides.

Saturated potassium iodide solution, in the cold, renders cotton hairs glassy and transparent, shrinkage and slight swelling, occurring without de convolution, while the hot saturated solution at 120 to 140 deg. Cent. produces decided swelling with retention of structure. On the other hand, a saturated solution of potassium mercuric iodide swells and gelatinizes yarns at once, and is a good solvent for cellulose (82), (83). Other iodides have been mentioned above.

Thiocyanates.

The solvent power of thiocyanate solutions, especially when heated, was discovered by Dubosc (38), who used the thiocyanates of ammonium, potassium, sodium, calcium and iron. Methods of technical solation have since been protected (9), (21). According to von Weimarn (185) any thiocyanate solution is capable of swelling and solating cellulose under suitable conditions, though Herzog and Beck (78) found under the conditions of their experiments that some thiocyanates are without solvent action. Calcium thiocyanate solutions proved very efficient solvents, and it was possible to obtain sols which set to more or less solid gels. Williams confirms (189), (190) these observations, and notes that the solvent power is increased by acids and reduced by alkalis. When calcium thiocyanate solutions act on cellulose, swelling first takes place, and, on stirring, a very viscous system results which gradually thins down. Preliminary addition of acetic acid eliminates the viscous stage. In the cold, the maximum solvent action (0.5 per cent) is possessed by 44 per cent solutions and mercerizing can be carried out by means of 60 per cent solutions.

Other Salts.

According to Councler (24), calcium bisulphite solution apparently modifies and dissolves cellulose. Klason (88) considers that cellulose proper is not dissolved by a solution of N/2-calcium or magnesium bisulphite, or N/6- sulphurous acid, whereas hydrocellulose and oxycellulose do dissolve. Cellulose is not attacked by heating with concentrated sodium bisulphite solution in sealed tubes at 130 to 140 deg. Cent. for 12 hours, but oxycellulose is dissolved (121).

Sodium sulphide has been suggested for mercerizing (158), although Huebner and Pope find with a 30 per cent solution but slight swelling and de-convolution (83).

Mechanical Dispersion.

This has been carried out in various liquids, but it is not known whether any swelling occurs in the process (133), (134), (135).

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Shirley Institute,
Didsbury.

FOREIGN DYES IMPORTED THROUGHT THE PORT OF NEW YORK DURING AUGUST

(*Continued from page* 656)

Schultz No.	Name of Dye and Manufacturer	Quantity (pounds)
500	Setocyanine	1,997
	*Setopailine Conc. 707—(G)	
503	Neptune Green	2,605
	†Erioviridine B Supra—(G)	
	*Guinea Fast Green B—(A)	
506	Erioglaucine	5,591
	*Erioglaucine AP 545—(G)	
515	Methyl Violet	200
	Methyl Violet NFB—(B)	
516	Crystal Violet	2,000
	Crystal Violet Extra Powder—(B)	
	Violet Crystals O—(M)	
524	Acid Magenta	500
	Acid Magenta—(C)	
543	Patent Blue	110
	†Patent Blue V—(A)	
545	Patent Blue A	330
	†Patent Blue A—(A)	
546	Cyanol	930
	*Cyanol Extra—(C)	
	*Cyanol FF—(C)	
	*Blue FF—(C)	
565	Acid Blue B	300
	*Wool Blue 5B—(A)	
571	Rhodamine 6G	8,386
	*Rhodamine 6G Extra—(B)	
	*Rhodamine 6GD Extra—(M)	
	*Rhodamine 6GDN Extra—(B)	
	*Rhodamine 6GDN Extra Conc.—(M)	
573	Rhodamine B	1,897
	†Rhodamine B Extra—(B)	
	†Rhodamine B Extra—(Q)	
	†Rhodamine B Extra Base—(B)	
606	Phosphine	440
	†Phosphine G—(By)	
	*Leather Phosphine G—(G)	
	*Leather Phosphine 2G—(G)	
608	Euchrysine	250
	†Euchrysine GRNTN—(B)	
612	Quinoline Yellow (spirit soluble)	100
	*Quinoline Yellow (spirit soluble)—(S)	
613	Quinoline Yellow (water soluble)	2,000
	†Quinoline Yellow (water soluble)—(S)	
618	Thioflavine T	550
	*Methylene Yellow H—(M)	
	*Basic Yellow T—(C)	
635	Modern Violet	440
	*Modern Violet—(DH)	
637	Gallamine Blue Paste	11,100
	*Gallamine Blue Extra Paste—(G)	
653	Nile Blue	400
	Danubia (Nile) Blue BX—(B)	
663	New Methylene Blue	1,000
	*New Methylene Blue N—(C)	
672	Azocarmine	1,400
	Azocarmine GX—(B)	
679	Saframine	110
	†Saframine Superfine Yellowish—(G)	
699	Induline (water soluble)	50
	Induline NN—(B)	
700	Nigrosine (water soluble)	1,264
	Nigrosine—(Q)	
	Nigrosine T—(B)	
759	Anthraflavone	392
	Anthraflavone GC Paste—(Q)	
760	Indan. Golden Orange G (sgle. stngth.)	2,829
	*Indan. Golden Orange G Pst.—(B)	
	*Indan. Golden Orange G Pdr.—(B)	
761	Indan. Golden Orange R (sgle. stngth.)	905
	*Indan. Golden Orange RRT Pdr.—(B)	
	*Indan. Gldn. Orange RRTS Pdr.—(B)	
	*Indan. Golden Orange 3R Pst.—(B)	
762	Indan. Scarlet GS (sgle. stngth)	208
	*Indan. Scarlet GS Pdr.—(B)	
765	Indan. Green B (sgle. stngth.)	10,800
	†Indan. Black BB Dbl. Pst.—(B)	
	*Indan. Blue Green B Dbl. Pst.—(B)	
767	Indan. Violet RR (sgle. stngth.)	800
	†Indan. Violet RR Pdr.—(B)	
778	Alizarine Synthetic	8,820
	†Alizarine VI Extra Pure B—(B)	
780	Alizarine Red	4,190
	*Alizarine Red S Powder—(B)	
	*Alizarine Red W Powder—(By)	
	*Alizarine Red S Powder—(Q)	
816	Algol Red 5G (single strength)	472
	*Algol Red 5G Powder—(By)	
820	Algol Brilliant Violet R (sgle. stngth)	1,984
	*Algol Brilliant Vioet R Powder—(By)	
822	Algol Brilliant Orange FR (sgle. stngth.)	1,027
	*Algol Brilliant Orange R Paste—(By)	
827	Indan. Claret B Extra (sngle. stngth)	1,400
	*Anthra Bordeaux R Powder—(B)	
	*Anthra Bordeaux R Paste—(B)	

No. Schultz	Name of Dye and Manufacturer	Quantity (pounds)
828	Indan. Claret B (sngle. stngth.)	3,520
	*Indan. Claret B Powder—(B)	
832	Indan. Violet RN (sngle. stngth.)	4,547
	*Indan. Violet BN Extra Paste—(B)	
	*Indan. Violet BN Paste—(B)	
	*Indan. Violet BN Paste, Fine—(B)	
	*Indan. Violet BN Powder—(B)	
834	Algol Gray (sgle. stngth.)	396
	Algol Gray 2B Paste—(By)	
838	Indan. Blue RS (sgle. stngth.)	1,203
	Indan. Blue RS Triple Powder—(Q)	
840	Indanthrene Blue 3G (sgle. stngth)	11,210
	†Indan. Blue 3G Paste—(B)	
	†Indan. Blue 3G Paste, Fine—(B)	
	†Indan. Blue 3G Powder—(B)	
841	Indan. Blue GGS (sgle. stngth)	250
	Indan. Blue 2GSNP Quintriple Powder—(B)	
842	Indan. Blue GCD (sgle. stngth.)	2,000
	†Indan. Blue GCD Dbl. Pst., Fine—(B)	
853	Anthraquinone Violet	220
	*Anthraquinone Violet Powder—(B)	
855	Alizarine Pure Blue	146
	*Alizarine Pure Blue B Powder—(By)	
856	Alizarine Astrol	830
	*Alizarine Astrol B Powder—(By)	
858	Alizarine Saphirol B	838
	†Alizarine Blue SAP—(By)	
	†Alizarine Light Blue B Conc.—(S)	
	†Alizarine Saphirol SE Powder—(By)	
859	Cyananthrol R	110
	*Cyananthrol RXO—(B)	
860	Cyananthrol G	1,020
	*Cyananthrol BGAOO—(B)	
861	Anthraquinone Blue SR	200
	*Anthraquinone Blue SR Ex. Pdr.—(B)	
862	Alizarine Blue Black	1,413
	†Alizarine Blue Black B—(Q)	
	†Alizarine Blue Black B Powder—(M)	
864	Anthraquinone Green	150
	*Anthra. Green GXNO Pdr.—(B)	
869	Algol Brown R (sgle. stngth.)	441
	*Algol Brown R Paste—(By)	
873	Indanthrene Pink	882
	Indanthrene Pink B. Dbl. Pst.—(B)	
885	Brilliant Indigo BD Paste	2,460
	Brilliant Indigo B Paste—(B)	
902	Helindone Brown 2R (sgle. stngth.)	207
	Helindone Brown 2R Paste—(M)	
906	Ciba Red G (sgle. stngth.)	551
	Ciba Red G Paste—(I)	
907	Ciba Scarlet (sgle. stngth.)	440
	*Helindone Fast Scarlet G Paste—(M)	
	*Thioindigo Scarlet 2G Paste—(K)	
908	Ciba Red R (sgle. stngth.)	1,102
	*Ciba Red R Paste—(I)	
911	Ciba Orange G (sgle. stngth.)	220
	Ciba Orange G Paste—(I)	
918	Helindone Red 3B (sgle. stngth.)	880
	*Helindone Red 3B Paste—(M)	
	Thioindigo Red 3B Paste—(K)	
923	Ursol	1,450
	†Ursol DG—(A)	
	†Ursol P—(A)	
	*Ursol Brown 2R—(A)	
	*Ursol Gray ALA—(A)	
	Ursol Red Brown 6R	

UNIDENTIFIED ACID DYES

Name of Dye and Manufacturer	Quantity (pounds)
*Acid Pure Blue R Supra—(G)	882
Acid Rhodamine BG—(B)	1,500
*Acid Red Violet—(Q)	11
*Acid Silver Gray—(Q)	22
*Acid Violet 7B Purple—(Q)	22
*Alizarine Direct Violet ER—(B)	100
Alizarine Rubinol	1,728
*Alizarine Rubinol GW Powder—(By)	
*Alizarine Rubinol 5G Powder—(By)	
*Alizarine Rubinol R Powder—(By)	
†Azorhodine 2GN Conc.—(S)	500
*Brilliant Milling Blue B—(C)	500
Brilliant Yellow Conc.—(S)	500
Guinea Fast Red	4,300
Guinea Fast Red BL—(A)	
*Guinea Fast Red 2BL—(A)	
Neolan Blue	771
*Neolan Blue B—(I)	
*Neolan Blue 2G Conc.—(I)	
Onis (Anthosine)	700
*Onis 3B—(B)	
Onis 5B—(B)	
Polar Red	5,248
†Polar Red G Conc.—(G)	
*Polar Red R Conc.—(G)	
*Polar Yellow 5G Conc.—(G)	2,205
Ponceau—(Q)	2
*Supramine Yellow R—(B)	200

UNIDENTIFIED VAT DYES

Name of Dye and Manufacturer	Quantity (pounds)
Algol Brown G Paste—(By)	165
Hydron Scarlet Paste	960
*Hydron Scarlet 3B Paste—(C)	
*Hydron Scarlet 3B Paste—(C)	
*Hydron Violet R (sgle. stngth.)—(C)	275
Indanthrene Brown 3R Paste—(B)	716
Indanthrene Orange 3R Paste—(B)	600
Vat Violet BR Paste—(Gr-E)	112

UNIDENTIFIED MORDANT AND CHROME DYES

Name of Dye and Manufacturer	Quantity (pounds)
*Acid Alizarine Gray G—(M)	2,235
*Alizarine Fast Gray 2BL—(By)	10
*Chromanol Blue NR—(DH)	220
†Eriochrome Flavine A Conc.—(G)	1,904
*Eriochrome Green O—(G)	110
*Metachrome Blue Black R—(A)	500
*Omega Chrome Brown PB Conc.—(S)	3,873

UNIDENTIFIED DIRECT DYES

Name of Dye and Manufacturer	Quantity (pounds)
Benzo Fast Blue FFL—(By)	220
*Benzo Fast Brown 3GL—(By)	462
*Benzo Fast Eosine BL—(By)	110
Benzo Fast Gray BL—(By)	324
*Benzo Rhoduline Red 3B—(By)	154
*Benzo Fast Violet BL—(By)	130
*Benzo Light Brown 3GL—(By)	441
†Diamine Fast Gray NBN—(MLy)	2,205
Diazamine Black N Extra—(MLy)	388
Diazophenyl Black V—(G)	2,205
*Direct Marine Blue—(Q)	2
*Good Direct R—(Q)	2
Naphthogene Blue B—(By)	249
Oxamine Fast Pink BX—(B)	125
Triazol Light Blue 4GL Powder—(Gr-E)	280
†Zambesi Black D—(A)	500

UNIDENTIFIED BASIC DYES

Name of Dye and Manufacturer	Quantity (pounds)
Brilliant Acridine Orange	330
*Brilliant Acridine Orange 3R—(DH)	
*Brilliant Acridine Orange 54—(DH)	
*Dahlia Violet—(Q)	11

UNIDENTIFIED SPIRIT SOLUBLE AND COLOR LAKE DYES

Name of Dye and Manufacturer	Quantity (pounds)
Lithol Fast Orange R Powder—(B)	2,000
Typophor Carmine FB—(B)	10
Typophor Yellow FR—(B)	200

UNIDENTIFIED, UNCLASSIFIED DYES

Name of Dye and Manufacturer	Quantity (pounds)
*Blue de France—(Q)	22
Fast Black LB Base—(Gr-E)	1
*Mandarin Yellow—(Q)	2
*Orseille Red—(Q)	2
*Reddish Brown Castor—(Q)	22

COLOR LAKES OF COAL-TAR ORIGIN

Name of Dye	Quantity (pounds)
†Azure Blue 315 BK	450
*Azure Blue 1137 K	1,000
*Brown Madder	22
Carmine Madder	203
†Crimson Madder of Alizarine	22
†Madder Lake	1,000
†Permanent Red	250
†Rose Madder Y	110
Viridine Lake 1028 H	1,000

SYNTHETIC AROMATIC CHEMICALS OF COAL-TAR ORIGIN

Name of Chemical	Quantity (pounds)
†Amyl Salicylate	206
†Anisic Aldehyde	50
*Benzophenone	22
†Benzyl Acetate	421
†Benzyl Benzoate	508
†Benzyl Formate	2.2
†Coumarin	2.2
*Cyclohexanol Acetate	4.4
†Diethyl Phthalate	21.9
†Heliotropin	2.2
*Methyl Methylanthranilate	64.4
*Musk Ambrette	725
*Musk Ketone	50
*Musk P. C	2,103
†Phenyl Acetaldehyde	75
†Phenyl Ethyl Acetate	35
†Phenyl Ethyl Alcohol	502
†Phenyl Ethyl Alcohol Extra	22
*Phenylbutyl Alcohol	2.2
*Phenyl Ethyl Butyl	1.1
*Phenysol	30
†Rose (for soap)	331

MEDICINALS, PHOTOGRAPHIC DEVELOPERS AND OTHER COAL-TAR CHEMICALS

Name of Chemical	Quantity (pounds)
*Aminopyrine	397
*Antalgol	5
*Antipyrine	1,880
*Antipyrine Crystals	35
Antoquinol, Pure	33
*Benzoate of Mercury	0.625
†Caffeine Sodio Benzoate	0.422
†Cresylic Acid, Pure	2,094
Developer B Powder	330
Developer Z (Phenylmethylpyrazolon)	110
†Diamine Phenol Hydrochloride	37.5
*Dimethylamidopyrin	20
*Dimethylamidopyrazolon	440
†Diethylaniline	3.3
†Dimethylaniline	5.6
*Enesol	22
*Enesol, amps. 5 c.c	0.39
†Epinine, 10 c.c	0.53
†Epinine, 25 c.c	9.84
*Epinine Hydrochloride	1

Name of Chemical	Quantity (pounds)
†Faturan Sheets (coal-tar products)	127
Glycin (Aminoacetic Acid)	50
*Guaiacol Cacodylate	5.3
Leucotrope W Conc	500
†Metol Hydroquinone Solution (gallons)	75
†a-Naphthol	1.65
†b-Naphthol	1.38
Naphthol ASSW Powder	1
*Para Cresol	50
Paraphenylenediamine	1,000
†Phenylacetic Acid, Refined	2.2
*Phenylethylpyrimidine	151
†Phenylhydrazine	14.3
†Phenylhydrazine Hydrochloride	7.15
*Physostigmine Salicylate	0.156
*Pyramidon (Dimethylamino-antipyrene)	1,500
*Pyrocatechol	3.3
†Resorcine Tech.	7,314
*Salicylate of Didymium	7.71
*Salicylate of Soda Solution	33
†Sodium Dioxynaphthalene Disulfonate Coml. (1′ 8′ 3′ 6′)	3.3
†Sulphanilic Acid	2.9
*Stovaine 0.01	1
†Thiophen	0.55
†Toluene	11
†Toluidine, Ortho	2.6
†Toluidine, Para	3.3
*Triolith (wood preservative)	440
†Uranine (Fluorescein Sodium)	2.6
*Wood Stains (coal-tar deriv.)	564

Imports for Consumption Through the Port of New York, May, June and July, 1923, of Color Lakes and Bacteriological Stains

(Including Reagents and Fine Organic Chemicals Imported in Small Amounts) Dutiable as Coal Tar Products Under Paragraphs 27 and 28.

The Department of Commerce and the United States Tariff Commission have collaborated in publishing monthly during the present year a list of the dyes imported for consumption through the port of New York. Beginning with the month of May, 1923, the list was extended to include synthetic aromatic chemicals and medicinals, pharmaceuticals, and other coal-tar products. However, the imports of color lakes and bacteriological stains have not been published.

The present list includes all of the color lakes and stains imported for consumption during the months of May, June and July, 1923.

The imports of color lakes for the three months totaled 43,378 pounds, with an invoice value of $17,295. The imports of bacteriological stains for the three months totaled 159.6 kilograms (351 pounds), with an invoice value of $2,921.

Of the total quantity of color lakes imported for the three months, 99 per cent came from Germany and 1 per cent from France. Of the total quantity of bacteriological stains imported for the three months, 98 per cent came from Germany and 2 per cent from England.

This is the first list of this character to be published, and it will be followed by similar lists at intervals of three months.

NEWPORT ANNOUNCES DIRECT FAST SCARLET 8BA

The Newport Chemical Works, Inc., has announced to the trade a new color, Newport Direct Fast Scarlet 8BA, which is a duplicate of the Benzo Fast Scarlet of the same brand as imported prior to the war.

This is a bright blue shade of Direct Scarlet which dyes very level and has good fastness to light, washing, acids and alkalies. It finds considerable use in the dyeing of cotton piece goods containing silk effects, which are left clean. It is also very valuable as a shading color in union dyeing because of its property of staining the wool only slightly. Its dyeings on cotton piece goods discharge to a pure white.

The new woolen mills, which were opened in March in the suburbs of Bombay, far surpass any of the fifteen woolen mills and factories already established in India. They have a complete wool washing and drying plant, eleven worsted cards, ten combs, 10,400 spindles of cap-spinning and 4,800 spindles of double machinery in the worsted department, and six sets of woolen cards and 2,280 mule spindles in the woolen department. The weaving section contains 124 woolen and worsted looms and a velvet-making plant of 100 looms.—Vice-Consul Robert F. Kelly, Calcutta.

The high prices asked for raw silk exercised an unfavorable influence on the imports of this commodity into Switzerland during the first quarter of this year. The imports of grege, tram and organzine totaled 280,300 bilos, with a value of 22,660,000 francs. Italy's share of these imports was valued at 17,500,000 francs, while the importation from Japan, which formerly was quite large, has almost entirely ceased, as the local prices are far below the Japanese.—Vice-Consul William H. Mathee, Zurich.

The recently created association for the promotion of the silk industry in France includes 50 professional groups, syndicates, and associations, the Parisian trade associations having now joined with those centering around Lyons. The activities of the new organization will include the agricultural, industrial, and commercial branches of the industry. Measures have been taken to bring to the attention of some 120 deputies, representing departments in which the silk industry is active, the importance of the development of sericulture in France, Algeria, Tunis, and other French colonies. —Commercial Attache Chester Lloyd Jones, Paris.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
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THE ADVANTAGES OF ORGANIZATION

NO more clean-cut demonstration of the purpose and usefulness of the Synthetic Organic Chemical Manufacturers' Association could be found than is furnished by its action anent the seizure and proposed sale of German dyestuffs by the French.

Not that the usefulness of the organization has been called into question, nor that it needs any defense. It merely happens that the incident referred to very well bears out the oft-repeated contention (vigorously made in these columns in less happy days, before the coal-tar industry was able to act as a unit) that an organization like it is essential to the chemical independence of this nation. Hence it is cited as an example.

When the French and Belgians seized some 6,200 tons of German-made colors, they proceeded to take out and deliver all those consigned as reparation colors to England and Italy, and likewise set aside enough of the seized dyestuffs to cover their own allotments from January 11 of the present year—the date of the Ruhr occupation and the cessation of German dye shipments—up to January 1, 1924.

This procedure left a remainder of some 3,500 tons which the French and Belgians proposed to sell in the open market, or at auction, to help pay the cost of seizure, etc.

Here at once was a very real danger to American dye manufacturers—that is, the smaller companies depending on specialties. Although at first glance it would hardly see mthat the sudden entrance upon the market of so comparatively small a poundage would seriously affect a country consuming some 55,000,000 pounds annually, it will readily be understood that such proportion of the seized German stocks as were competitive under the U. S. Appraiser's designation could in some cases constitute a year's supply—which, if allowed to go at sacrifice prices, would, even if assessed at the American valuation, knock the bottom out of the market and put many of the small specialty men out of business.

This danger was promptly realized by the S. O. C. M. A., which took due cognizance of the fact that here was a possibility of injury through a channel which could not have been foreseen by Congress when the present protective measure was framed. Likewise, the Anti-Dumping law would offer no protection, for in this instance the cost of production figured not at all in the selling price of the dyes, and, further, this law does not go into operation until after the damage has been done—small comfort to those who might be forced to the wall!

In such an unforeseen emergency, the only Government department which could logically act was the Department of State, and accordingly a letter was drafted by the association requesting that friendly representations be made to France suggesting that, in view of the far-reaching and serious consequences which unrestricted sale of the dyes might entail, competitive colors from the seized dyes be not allowed to come to this country, or, if sold here, that they be not sold at prices lower than the customary German import prices. It was carefully explained that so far as non-competitive colors went, there could be no possible objection to their coming here and no resulting damage, and that the association was desirous of seeing American dye consumers share in whatever benefits might accrue from their sale at sacrifice prices. The situation was well covered by the letter, two paragraphs of which we here quote:

"The situation with respect to the possible sale by the French 'Union' for export to this country of dyes which are held to be competitive with American-made products will create a very serious condition. At the present moment a list showing the various dyes composing the total of thirty-five hundred tons, and the amounts of each dye, is not available. It is safe to assume, however, that this thirty-five hundred tons is composed in part of dyes which are not yet manufactured in this country, and in part of dyes manufactured here which are readily available to American consumers. The sale for export of dyes which compete directly with those of American manufacture would not, of course, upset the French market, but if these dyes were sold at low prices and in considerable quantities for export to this country they would undoubtedly have a most unsettling effect upon this market and in certain cases would seriously affect—if not entirely stop—the sale of competing American-made products. Such sales could have an even more serious effect in that the American dye producer might be forced to discontinue not only the sale but the manufacture of certain of his products. In the case of a small manufacturer producing a restricted line of high-class products, such importation would mean financial ruin—he would simply cease to exist.

"It is not the desire of the dye manufacturers in this country to deprive the American dye consumers of any

and all dyes which are not obtainable here on reasonable terms. No question is raised regarding any and all dyes embraced within the aforesaid thirty-five hundred tons, which are not held to be similar to or competitive with American-made products, as evidenced by official list of such 'non-competitive' dyes published by the Treasury Department—copies herewith attached. It is assumed and hoped that supplies of needed dyes may be obtained for the benefit of the American dye consumer."

The State Department acted promptly, notifying its representatives at the American Embassy at Paris of the situation, authorizing an investigation to determine what proportion of the colors might be competitive, and further authorizing its representatives, in the event of threatened danger, to take the matter up with the French Government.

Subsequent to the sending of this letter to the State Department, the association learned that of the 2,000 tons available for sale about 58 per cent consisted of competitive colors under the Appraiser's designation, thereby showing the danger to have been a real one.

Now, if one contrasts the prompt and complete compliance of the State Department with the sort of treatment which would have been accorded the industry a few years ago, when it was unorganized and chaotic, presenting no solid front and unable even to think as a unit, there should be no necessity for any further preachment as to the wisdom of having such an organization, which is not only able to spend its entire time in finding out just what the industry's rights and needs are, but which likewise is able to present those rights and needs quickly, with definiteness and certainty, to the proper authorities, thus gaining recognition and respect never shown to unorganized groups whose individual members are acting independently of one another.

And, incidentally, it would not be amiss to state in conclusion that the thanks of the industry are due the State Department for its speedy recognition and courteous compliance with a just claim.

FRED E. SIGNER

As we go to press we learn with profound regret of the death of Fred E. Signer, vice-president of the Synthetic Organic Chemical Manufacturers' Association of the United States and sales manager of the Butterworth-Judson Company. Mr. Signer, who was fifty-four years old, passed away at his home in Bronxville, N. Y., after an illness of one week.

He was well known in railroad circles, having served successively with the Buffalo, New York & Philadelphia, Chicago & Atlantic, Southern Pacific, Chicago & Alton, Wabash, Wisconsin Central, Lehigh Valley and Soo Line railroads. He resigned as general eastern freight agent of the Lehigh Valley Railroad to accept the position he was holding at the time of his death.

He was a member of the board of governors of the Traffic Club of New York and held memberships in the Drug and Chemical and the Ardsley clubs. He is survived by a widow, Mrs. Lyle W. Signer; two daughters, Marjorie and Dorothy, and a brother, Charles.

MATHIESON AGAIN TO SHOW MODEL BLEACH PLANT FOR PAPER MILLS

The spaces to be occupied at the forthcoming Chemical Show by the Mathieson Alkali Works will be Nos. 206, 207 and 208, the same spaces occupied at previous chemical expositions, and on this space the company will have erected a special booth.

There will be shown the model bleach plant for paper mills, showing the preparation of bleach liquor chlorine by the Mathieson system. The company will also have in its booth its 100 and 150 pound cylinders of liquid chlorine, samples of caustic soda, soda ash, bleaching powder, modified Virginia soda, bicarbonate of soda, benzoate of soda, benzoic acid and coumarin. There will also be on hand literature describing the Mathieson hypochlorite process for refining gasoline and kerosene, and booklets covering the uses of Mathieson products in other industries.

In charge of the booth will be J. W. Boyer, manager of sales, and R. J. Quinn, assistant manager of sales, assisted by E. E. Routh, W. D. Marshall, J. B. Peake and Philip De Wolf, district sales managers.

BEAVER SULPHUR BLUE PLANT NOW REBUILT AND RUNNING

The Beaver Chemical Corporation, of Damascus, Va., has rebuilt and is now operating its Sulphur Blue plant, which was destroyed by fire on May 21. Prompt deliveries are now available on all of its well-known standards—viz., Sulphur Blue BCG, BC Extra, BCR, BC2R—which have heretofore proven so satisfactory. The Dunker & Perkins Company, which recently acquired a substantial interest in the Beaver Chemical Corporation, and which handles this account in New England, is also prepared to make prompt deliveries on any of the above products.

Stocks of raw wool on hand in Antwerp on January 1, 1923, totaled 1,168 bales, with arrivals during the first six months of the present year amounting to 240,082 bales, of which 159,742 bales were Australian. Sales during the six months totaled 7,200 bales and 231,454 bales were listed as in transit, leaving a stock of 2,596 bales at the end of June.

The Holyoke Plush Company, Holyoke, Mass., which has been established for more than thirty years, has closed its plant at Smith and Main Streets, preparatory to going out of business.

Italian Chamber Passes New Dyestuff Tariff Law

No Duty on Swiss Sulphur Colors—Duty on Hydrochloric and Sulphuric Acids Abolished—Revision of Freight Rates on Ultramarines Proposed—American Investors to Aid Italian Industrial Development

Genoa, August 14.
Special to The Reporter.

FOLLOWING the attempted alteration of the tariff laws with respect to coloring matters, which was not consummated owing to the absence of a quorum at the former session of the Chamber of Deputies, this measure was made a law at the following session. By virtue of it, the sulphur colors are exempted from import duty in the case of Switzerland; dry aniline colors and those with a water content up to 50 per cent are to be assessed 200 gold lire per 100 kilos and 0.5 of majoriation; while colors with a higher water content are entirely exempted from import duty. The duty on hydrochloric acid and sulphuric acid has been abolished; the duty on carbonate of soda crystals has been increased from 1 to 2 gold lire per 100 kilos, and the duty on calcium chloride is increased from 1 to 1½ gold lire per 100 kilos.

Freight Rates on Ultramarines

Before the extraordinary commissary of the state railways there is now pending a question of strong interest, not only for the firms that produce coloring matters but also for those that employ the same in production or manufacturing operations. This refers to a proposed revision of the railway tariffs on the ultramarines. So far no difference has been made between the natural and the artificial product, although there is a great difference in the value of the two products.

The natural product (lapis lazuli) is imported in Italy from the Baikal Lake, from Afghanistan and from Chile, costing in the raw condition 20,000 lire per kilo and 40,000 lire when worked. Reduced to powder, it was employed long ago as a coloring matter, but at present it serves only for the ornamentation of precious objects.

The artificial product costs only from 2.50 to 6 lire per kilo, and is a compound of china clay, carbonate of soda and sulphur. It is largely employed for industrial purposes, in which it is practically irreplaceable for the bluing of fabrics, paper, paper pulp, starch, sugar, soaps, etc. The industry for the production of ultramarine, founded some years ago in Italy, is now working under favorable conditions.

The business of the Societa Generale dei Colori, of Milan, has caused the shareholders of this firm to consider the reduction of the capital from 2,500,000 lire to 1,000,000 lire through bringing the value of the shares from 250 to 100 lire. The balance of the Fabbricazione Italiana Colori Vernici e Smalti L. Rambaud, of Genoa, of the last financial year shows a loss of 315,733 lire, to which is to be added the residual loss of 58,362 lire of the preceding financial year. Also the Colorificio Val Polcevera, of Genoa, suffered a loss of 58,432 lire during the last financial year, to which was, however, added the residual net profit of 103,325 lire made during the preceding financial year.

American Investments in Italy

There are rumors that J. E. Affred, representative of an important bank group in North America, has informed the Italian President of Ministers, Mussolini, that through his initiative has been founded in New York "The Italian Power Company," with a capital of two million dollars entirely subscribed. This association, composed of an important group of American business men, has the object of collaborating in the development of the Italian industry and finances. It is the general opinion that if this first important essay of investment of American capital in Italy has the success that is foreseen it will soon give life to other enterprises.

Italian Money Investments

During June the total increases of capital reached 524,455,400 lire, being distributed over 115 firms. During the same month there were founded 157 limited companies, with a total capital of 94,387,750 lire. There were fifty-four failures, representing 56,001,800 lire in the aggregate; thirty-nine reductions of capital for 61,148,925 lire, and one fusion for 4,000,000 lire.

During the first five months of this year Italy imported chemicals, medicinals, resins and coloring matters to the value of 490,686,700 lire, as against 469,871,929 lire during the same months of 1922, and exported to the value of 157,545,537 lire, as against 161,678,538 lire in 1922.

Demand for Coloring Matters

The demand for coloring matters was reduced during the past five weeks through the period of hot

weather and holidays and the continuance of the crisis in the Italian cotton industry, being centered, as usual, upon war reparation products and on coloring matters imported through private firms. Some of the colors supplied were as follows: Tartrazine, Azofuchsine, Diamine Catechine, Fast Milling Red, Congo Red, Chloramine Yellow, Direct Sky Blues, Primulin, Diazo Black BH, Acid Navy Blues, Direct Bordeaux, Amido Naphthol Blacks, Alizarine Reds, Alizarine Blues, Alizarine Yellows, Indigo, Eosine, Phloxine, Erythrosine, the Rhodamines, the Safranines, Bismarck Brown, the Methyl Violets, the Malachite Greens, Acid Magenta, Direct Cutch Brown, Steel Grays, Acid Navy Blues, Naphthylamine Blacks, Fast Milling Reds, the Ponceaux, the Water Blues, the Indulines, the Columbia Blacks, the Chicago Blues, Carmoisine, the Direct Violets, the Ericas, etc. The requests were distributed, as usual, over the cotton, wool, silk, jute, artificial silk, paper, leather, artificial flowers, ink and other industries.

Mordants, Assistants and Dyehouse Products

The crisis in the cotton industry, the hot weather that caused many of the industrialists and merchants to transport their families to the mountains, suspending for the time being all purchases, rendered the Italian chemical market very calm and the demand for mordants, assistants and dyehouse products nearly nil. Besides this, many of the sellers themselves were absent. The prices were, however, little changed for the few transactions conducted, owing also to the very high foreign exchange and the anticipation of a recovery in the demand later on.

Private Dyehouse Quotations

Some private quotations for dyestuffs at Genoa were as follows, per kilo, showing how these competed against the war reparation products: Direct Black, 25 to 28 lire; Nigrosine Crystals, 22 to 23 lire; Sulphur Black, 7.20 to 10.75; Chrome Black in powder, 28 to 32 lire; Acid Black, 24 to 26 lire; Direct Green, 28 to 30 lire; Sulphur Blue, 22 to 25 lire; Eosine, 51 to 75 lire; Bismarck Brown, 28 to 34 lire; Orange II, 21 to 24 lire; Methylene Blue, 75 to 91 lire; Liquid Fustic Extract, 7 to 7.50 lire; Logwood Extract, 6.50 to 7.50 lire; Hematine Crystals, 10 to 12 lire.

Business in mineral colors was much reduced during the past seven weeks through the period of holidays begun in July and through the lower employment of colors in shipbuilding, railway constructions, repairs, industry, etc.

The part of the Hinsdale Woolen Mills, Hinsdale, Mass., known as the Broad Mill, has been sold by Francis H. Holmes, of New York, to William S. Jones, 448 Pecks Road, Pittsfield, Mass.

WOOL AND SILK IMPORTS; EXPORTS OF COTTON GOODS

Imports of wool in July totaled 13,422,000 pounds, which may be compared with 30,129,000 pounds in June and 33,434,000 pounds in July, 1922. Exports of cotton goods amounted to 30,288,000 square yards, as against 35,066,000 in June and 60,238,000 square yards in July a year ago. The total spindle activity in cotton mills aggregated 7,136,000,000 hours, as compared with 8,385,000,000 in June, while the activity per spindle at 191 hours showed no change from July a year ago and may be compared with the June spindle activity amounting to 224 hours. Imports of silk totaled 6,380,000 pounds, as compared with 3,945,000 in June and 4,102,000 pounds in July, 1922. Burlap imports, totaling 43,950,000 pounds, declined from June and may be compared with a total of 36,575,000 pounds imported in July a year ago. Imports of unmanufactured fiber aggregated 20,055,000 pounds, an increase of 10 per cent over the preceding month and of 22 per cent over July, 1922.

NEWPORT ANNOUNCES ANTHRENE BLUE GREEN B AND NEWPORT CHROMOTROPE CZR

Anthrene Blue Green B is a new product recently announced by the Newport Chemical Works, Inc., as the latest addition to its line of vat colors. This product is the same in shade as Indanthrene Blue Green B, but is faster to both chlorine and light than the imported type.

The company likewise announces Newport Chromotrope CZR, which is a new product that produces the same results as Chromazone Red New Conc. 540. It is a very bright, blue shade of red which chroming turns to a blue. The fastness is good, and compares with the other Chromotrope brands.

The position of the British wool industry was not so favorable during the first six months of 1923, reports Trade Commissioner Hugh D. Butler, London, England. On account of old orders carried over from last year by all branches of the trade, more particularly top makers and spinners, this change has been slow to manifest itself in the current figures of employment, exports, etc. Stocks of merino tops are larger, and, comparatively speaking, those of medium and low-grade crossbreds smaller than last year's. The market for Bradford yarns is flat, and a number of large orders are held up awaiting detailed instructions. On every hand complaint of a lack of new business is made. A special circular (Tex.—177, "The British Wool Industry in the First Half of 1923"), reviewing all phases of the industry, may be obtained upon application to the district and co-operative offices of the Bureau of Foreign and Domestic Commerce or the Textile Division at Washington, D. C.

FINISHING PANT AND TRUNK LININGS

One style of pant lining is used largely in a printed form, though it is also the piece-dyed. It finishes firm and mellow and glossy—but not glazed.

Gray Cloth—Before Bleaching

Length	(yards)	60
Width	(inches)	41
Counts		80 x 48
Weight	(pounds)	12
Finished width	(inches)	39

After bleaching and dyeing or printing, the cloth is starched twice on the back only, on the backfilling machine, with the following mixture:

Cornstarch	(pounds)	44
China clay	(pounds)	90
Oliene (50 per cent)	(gallons)	2
Ultramarine blue	(pints)	2

Water sufficient to make when boiled 100 gallons.

Boil twenty minutes.

This is for printed cloths with white grounds. If the goods are dyed the bluing must be left out and the starch mixture should be colored, if possible, the same color as the goods so that the clay will not show through from the back.

After starching and drying, the goods are allowed to cool. They are then conditioned on the damping machine and allowed to lie for two hours, after which they are heavily hot calendered on a dead set calender (three to five bowls) using a heavy pressure. They are then stretched to width on a stretcher and heavily calendered again.

The following is for a trunk lining finish:

Gray Cloth—Before Bleaching

Length	(yards)	70
Width	(inches)	41
Counts		76 x 48
Weight	(pounds)	10½
Finished width	(inches)	39½

After bleaching, dyeing and mangling, the cloth is dried and then filled on a three-bowled mangle with the following mixture:

Cornstarch	(pounds)	100
Barytes	(pounds)	50
Bone fat	(pounds)	12

Water sufficient to make when boiled 100 gallons.

Boil ten minutes.

After once filling, the cloth must be dried and starched again with the same mixture, then dried and allowed to cool. The cloth is then well conditioned on the damping machine and allowed to lie about two hours. It is afterwards passed through a friction calender using a heavy pressure but a low temperature. It is then stretched to width on a stretcher and run twice more on the friction calender. The cloth is then passed over a hot cylinder to drive out the moisture and remove the luster.

The idea is to so finish the cloth as to close up all the interstices between the threads and to make the goods smooth without being glazed. Should more glaze be required the calender can be run hotter.

Another good formula for trunk linings is as follows:

Cornstarch	(pounds)	15
Barytes	(pounds)	20
Water	(gallons)	15

Cool this mixture down to 150 deg. Fahr. and then add 1 pound malt extract, 1 pound stearine and 4 pounds glue, all previously dissolved in lukewarm water. Dissolve the glue first in hot water, then stearine in the glue and pour it into the starch. Then add the malt extract previously dissolved in lukewarm water. The idea that I wish to convey is that no hot water must touch the malt extract or it will destroy its action; that is why we cool the starch down to 150 deg. Fahr. In a short time after the extract is added the starch will go thin with stirring (it must be kept stirring). This will take only a few minutes, and just as soon as the starch begins to liquefy and go thin turn on the steam and boil all up. The glue and wax can be added during this final boil up and it would perhaps be best.

The final boiling is done to stop the further action of the malt extract. If this action were not stopped, either by boiling or the addition of an alkali, the extract would convert all the starch into sugar and destroy its stiffening power. After starching and drying, the goods must be run again, dried, damped and calendered, stretched, etc., as in the previous methods.

As most of these cloths for trunk linings are run twice through the starch and are for dyeing into light shades, the dyeing and starching may be conducted at one operation by adding the coloring matter to the starch.—Cotton.

During the first quarter of 1923 Polish imports of textile raw materials were valued at $16,300,000, representing 30 per cent of the total imports for that period. Raw cotton was the principal item, amounting to $7,700,000. About 85 per cent, or 66,774 bales, of this cotton came from the United States.

A resolution has recently been passed by the executive committee of the Saxon Chambers of Commerce, according to which the admission of foreigners in Saxon professional institutes, especially textile schools,

shall, in the future, be subject to the consent of the various State governments, at the discretion of the respective chambers of commerce.

FINISHING CRETONNES

Softeners are prepared either by the saponification of an oil or a fat in presence of an insufficient quantity of alkali or by adding to the hot oil a solution of soap and then boiling the mixture. The last-named process enables the oil to be emulsified in a soap with an oil base of another nature; for example, olive oil with a cocoanut oil soap. For the soda softeners olive oil is used, and for the potash softeners tallow is used as a free fat. For each part of the oil by weight seven parts of water and three parts of dry soap are added.

As a rule, the printing of oiled fabrics can be accomplished only with basic colors, oiling the cloth with sulphonated castor oil. Castor oil has a density of 0.962 or 0.964, and the composition is prepared by mixing 12.5 pounds of sulphuric acid at 60 deg. Be. with 50 pounds of castor oil. The acid is added slowly while the mixture is being continually stirred, the temperatnre not going above 85 deg. Fahr. The mixture is left standing for twenty-four hours, after which 100 pounds of lukewarm water is added, water obtained by condensing steam being generally used. The mixture is then left standing for forty-eight hours, and the water is then drawn off as completely as possible, after which the oil thus obtained is neutralized either with 125 pounds of 25 per cent ammonia or 30 pounds of caustic soda at 20 deg. Be. The product in each case is 100 pounds of 50 per cent oil.

The use of sulphonated oil has the advantage of enabling a uniform product to be applied to the goods. The fabric to be printed should be boiled off in order to remove all the sizing, this being accomplished in five hours under a pressure of two atmospheres with 3 per cent of carbonate of soda or with silicate of soda at 40 deg. Be. The sizing is removed either with malt or with preparations of diastase, using from 30 to 50 parts of malt by weight to 1,000 parts of oil, and rinsing in pure water. The oil bath is prepared with 30 to 50 parts by weight of oil to 1,000 parts if the fabric is dry, and from 50 to 70 parts of the sulphonated oil is used if the goods are entered wet. An excess of oil has a tendency to yellow the cloth.—Textiles.

The importation of British wool goods has been made practically prohibitive by the depreciation of Portuguese currency and the high import duties. Increased home production of wool manufacturers has resulted in an oversupply of domestic goods, while excessive advances in prices made by jobbers and retailers have resulted in a marked falling off in demand.

The Pee Dee Manufacturing Company, Rockingham, N. C., has awarded a contract for a waterwheel and generator for its mill No. 1, which is to be electrified. About 500 horse-power will be generated.

A contract has been awarded for the erection of a four-story addition to the Pawtucket plant of the Lorraine Manufacturing Company, Mineral Spring Avenue. The addition will be 44 by 100 feet, and will cost $40,000.

The James Cotton Mills have been incorporated at Maiden, N. C., with a capital stock of $200,000. The incorporators, all of whom reside in Lincolnton, are A. L. Quickel, J. D. Abernethy and J. A. Abernethy.

The L. B. Luthien Dye Works, Inc., Philadelphia, have been chartered, with a capital of $400,000, to establish and operate a local mill. Henry Wiegand, Jr., 1821 East Tioga Street, is treasurer of the new company.

Charles A. Lapworth, webbing manufacturer, Bridgewater, Mass., has let the contract for the erecttion of a factory to cost about $50,000. The building will be one story, approximately 65 by 150 feet. Construction work is expected to go ahead next month.

The Darlington Manufacturing Company is replacing 262 old looms with Draper looms with dobby attachments and 11,776 spindles.

The Manetta Mills, Lando, S. C., at a meeting next Tuesday will consider a proposed issue of $150,000 7 per cent cumulative preferred stock. The new stock will mature in ten years from date of issue, but may be retired at par at any interest date.

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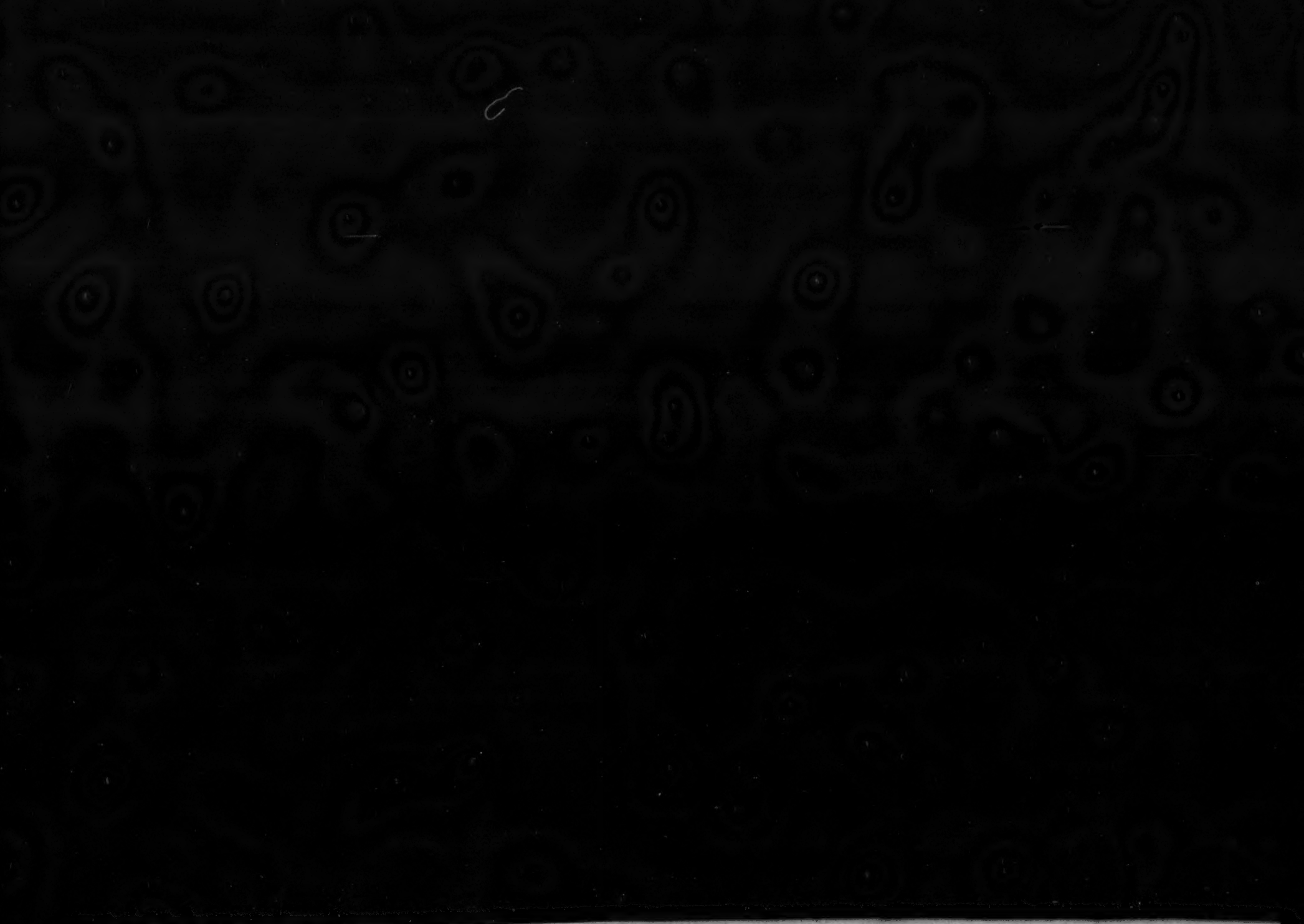
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